# NTLJF4156N

# MOSFET – Power, N-Channel with Schottky Barrier Diode, Schottky Diode, μCool, WDFN 2X2 mm

## 30 V, 4.6 A, 2.0 A

### Features

- WDFN Package Provides Exposed Drain Pad for Excellent Thermal Conduction
- Co−Packaged MOSFET and Schottky For Easy Circuit Layout
- $R_{DS(on)}$ Rated at Low $V_{GS(on)}$ Levels, $V_{GS}$ = 1.5 V
- Low Profile (< 0.8 mm) for Easy Fit in Thin Environments
- Low $V_F$ Schottky
- This is a Pb−Free Device

### Applications

- DC−DC Converters
- Li−Ion Battery Applications in Cell Phones, PDA's, Media Players
- Color Display and Camera Flash Regulators

**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise noted)

| Parameter | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain−to−Source Voltage | | | $V_{DSS}$ | 30 | V |
| Gate−to−Source Voltage | | | $V_{GS}$ | ±8.0 | V |
| Continuous Drain Current (Note 1) | Steady State | $T_J$ = 25°C | $I_D$ | 3.7 | A |
| | | $T_J$ = 85°C | | 2.7 | |
| | t ≤ 5 s | $T_J$ = 25°C | | 4.6 | |
| Power Dissipation (Note 1) | Steady State | $T_J$ = 25°C | $P_D$ | 1.5 | W |
| | t ≤ 5 s | | | 2.3 | |
| Continuous Drain Current (Note 2) | Steady State | $T_J$ = 25°C | $I_D$ | 2.5 | A |
| | | $T_J$ = 85°C | | 1.8 | |
| Power Dissipation (Note 2) | | $T_J$ = 25°C | $P_D$ | 0.71 | |
| Pulsed Drain Current | $t_p$ = 10 μs | | $I_{DM}$ | 20 | A |
| Operating Junction and Storage Temperature | | | $T_J$, $T_{STG}$ | −55 to 150 | °C |
| Source Current (Body Diode) (Note 2) | | | $I_S$ | 2.4 | A |
| Lead Temperature for Soldering Purposes (1/8″ from case for 10 s) | | | $T_L$ | 260 | °C |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

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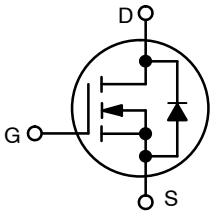
**MOSFET**

| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX (Note 1) |
|---|---|---|
| 30 V | 70 mΩ @ 4.5 V | 4.6 A |
| | 90 mΩ @ 2.5 V | |
| | 125 mΩ @ 1.8 V | |
| | 250 mΩ @ 1.5 V | |

**SCHOTTKY DIODE**

| $V_R$ MAX | $V_F$ TYP | $I_F$ MAX |
|---|---|---|
| 30 V | 0.47 V | 2.0 A |




N−CHANNEL MOSFET

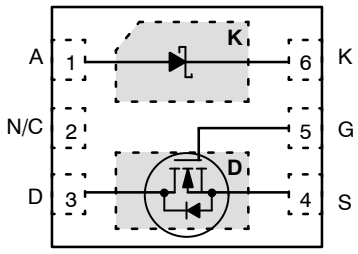

SCHOTTKY DIODE


**WDFN6**
**CASE 506AN**

**MARKING DIAGRAM**


JL = Specific Device Code
M = Date Code
▪ = Pb−Free Package
(Note: Microdot may be in either location)

**PIN CONNECTIONS**




(Top View)

**ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 8 of this data sheet.

1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
2. Surface Mounted on FR4 Board using the minimum recommended pad size of 30 $mm^2$, 2 oz. Cu.

**SCHOTTKY DIODE MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage | $V_{RRM}$ | 30 | V |
| DC Blocking Voltage | $V_R$ | 30 | V |
| Average Rectified Forward Current | $I_F$ | 2.0 | A |

**THERMAL RESISTANCE RATINGS**

| Parameter | Symbol | Max | Unit |
|---|---|---|---|
| Junction−to−Ambient − Steady State (Note 3) | $R_{\theta JA}$ | 83 | °C/W |
| Junction−to−Ambient − t ≤ 5 s (Note 3) | $R_{\theta JA}$ | 54 | |
| Junction−to−Ambient − Steady State Min Pad (Note 4) | $R_{\theta JA}$ | 180 | |

3. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).
4. Surface Mounted on FR4 Board using the minimum recommended pad size of 30 $mm^2$, 2 oz. Cu.

**MOSFET ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C unless otherwise noted)

| Parameter | Symbol | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain−to−Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 250 μA | | 30 | | | V |
| Drain−to−Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $I_D$ = 250 μA, Ref to 25°C | | | 18.1 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 24 V, $V_{GS}$ = 0 V | $T_J$ = 25°C | | | 1.0 | μA |
| | | | $T_J$ = 85°C | | | 10 | |
| Gate−to−Source Leakage Current | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±8.0 V | | | | 100 | nA |
| **ON CHARACTERISTICS** (Note 5) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | | 0.4 | 0.7 | 1.0 | V |
| Gate Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | | 2.8 | | mV/°C |
| Drain−to−Source On−Resistance | $R_{DS(on)}$ | $V_{GS}$ = 4.5, $I_D$ = 2.0 A | | | 47 | 70 | mΩ |
| | | $V_{GS}$ = 2.5, $I_D$ = 2.0 A | | | 56 | 90 | |
| | | $V_{GS}$ = 1.8, $I_D$ = 1.8 A | | | 88 | 125 | |
| | | $V_{GS}$ = 1.5, $I_D$ = 1.5 A | | | 133 | 250 | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 10 V, $I_D$ = 2.0 A | | | 4.5 | | S |
| **CHARGES, CAPACITANCES AND GATE RESISTANCE** | | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 1.0 MHz, $V_{DS}$ = 15 V | | | 427 | | pF |
| Output Capacitance | $C_{OSS}$ | | | | 51 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | | 32 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 15 V, $I_D$ = 2.0 A | | | 5.4 | 6.5 | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | | 0.5 | | |
| Gate−to−Source Charge | $Q_{GS}$ | | | | 0.8 | | |
| Gate−to−Drain Charge | $Q_{GD}$ | | | | 1.24 | | |
| Gate Resistance | $R_G$ | | | | 3.7 | | Ω |

5. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
6. Switching characteristics are independent of operating junction temperatures.

**MOSFET ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C unless otherwise noted)

| Parameter | Symbol | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **SWITCHING CHARACTERISTICS** (Note 6) | | | | | | | |
| Turn−On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = 4.5 V, $V_{DD}$ = 15 V, $I_D$ = 2.0 A, $R_G$ = 2.0 Ω | | | 4.8 | | ns |
| Rise Time | $t_r$ | | | | 9.2 | | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | | | 14.2 | | |
| Fall Time | $t_f$ | | | | 1.7 | | |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Recovery Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, IS = 2.0 A | $T_J$ = 25°C | | 0.78 | 1.2 | V |
| | | | $T_J$ = 125°C | | 0.62 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, $d_{ISD}/d_t$ = 100 A/μs, $I_S$ = 2.0 A | | | 10.5 | | ns |
| Charge Time | $t_a$ | | | | 7.6 | | |
| Discharge Time | $t_b$ | | | | 2.9 | | |
| Reverse Recovery Time | $Q_{RR}$ | | | | 5.0 | | nC |

5. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
6. Switching characteristics are independent of operating junction temperatures.

**SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C unless otherwise noted)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage | $V_F$ | $I_F$ = 0.1 A | | 0.34 | 0.39 | V |
| | | $I_F$ = 1.0 A | | 0.47 | 0.53 | |
| Maximum Instantaneous Reverse Current | $I_R$ | $V_R$ = 30 V | | 17 | 20 | μA |
| | | $V_R$ = 20 V | | 3.0 | 8.0 | |
| | | $V_R$ = 10 A | | 2.0 | 4.5 | |

**SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS** ($T_J$ = 85°C unless otherwise noted)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage | $V_F$ | $I_F$ = 0.1 A | | 0.22 | 0.35 | V |
| | | $I_F$ = 1.0 A | | 0.40 | 0.50 | |
| Maximum Instantaneous Reverse Current | $I_R$ | $V_R$ = 30 V | | 0.22 | 2.5 | mA |
| | | $V_R$ = 20 V | | 0.11 | 1.6 | |
| | | $V_R$ = 10 V | | 0.06 | 1.2 | |

**SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS** ($T_J$ = 125°C unless otherwise noted)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage | $V_F$ | $I_F$ = 0.1 A | | 0.2 | 0.29 | V |
| | | $I_F$ = 1.0 A | | 0.4 | 0.47 | |
| Maximum Instantaneous Reverse Current | $I_R$ | $V_R$ = 30 V | | 2.0 | 20 | mA |
| | | $V_R$ = 20 V | | 1.1 | 10.9 | |
| | | $V_R$ = 10 V | | 0.63 | 8.4 | |

**SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C unless otherwise noted)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Capacitance | C | $V_R$ = 5.0 V, f = 1.0 MHz | | 38 | | pF |

7. Surface−mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).
8. Surface−mounted on FR4 board using the minimum recommended pad size of 30 $mm^2$, 2 oz cu.
9. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤2%.
10. Switching characteristics are independent of operating junction temperatures.

## TYPICAL PERFORMANCE CURVES ($T_J$ = 25°C unless otherwise noted)

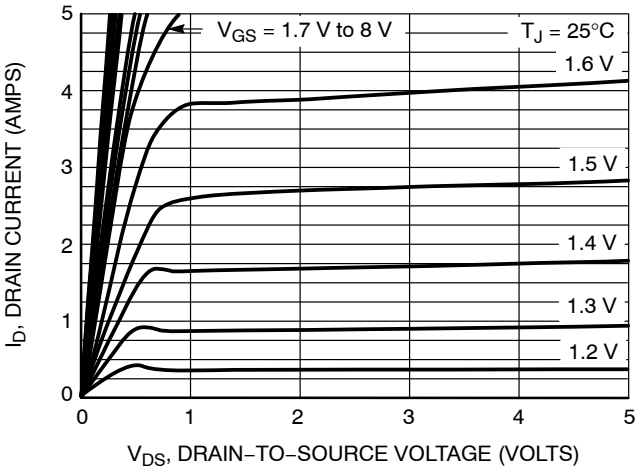



**Figure 1. On−Region Characteristics**

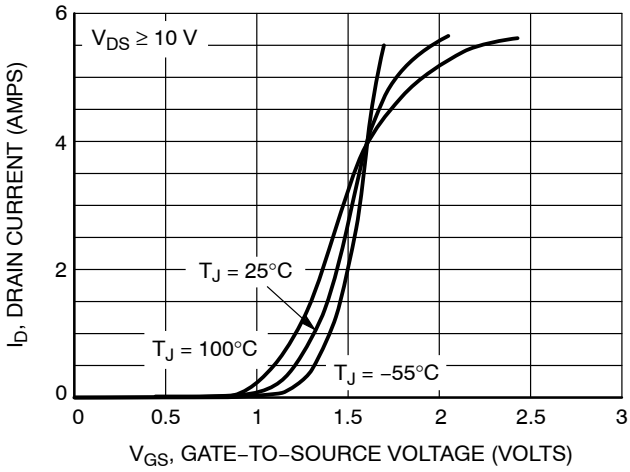



**Figure 2. Transfer Characteristics**

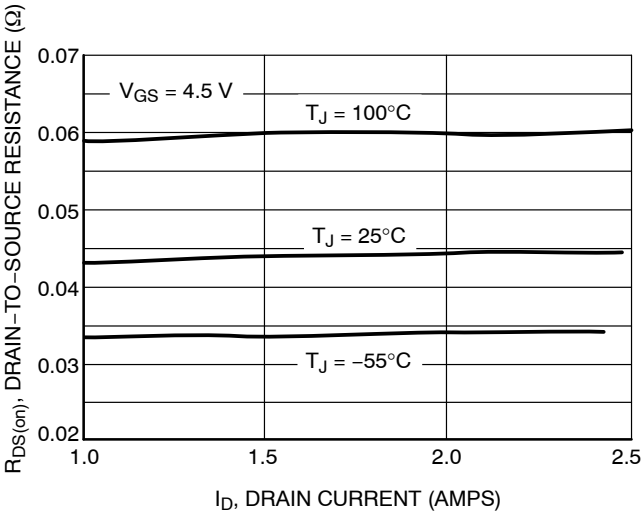



**Figure 3. On−Resistance versus Drain Current**

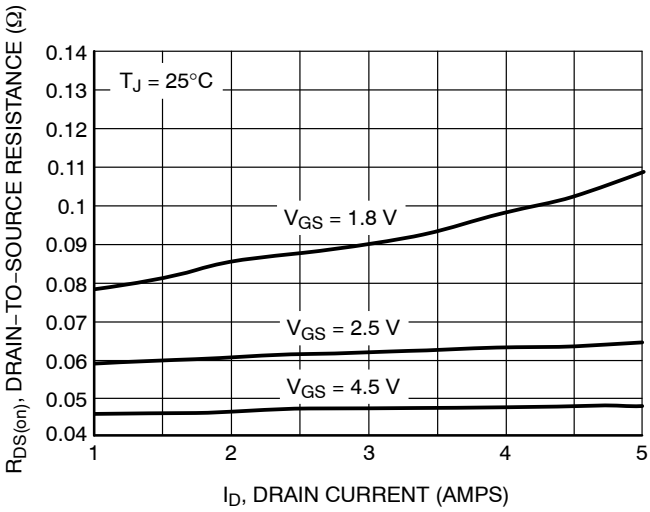



**Figure 4. On−Resistance versus Drain Current and Gate Voltage**

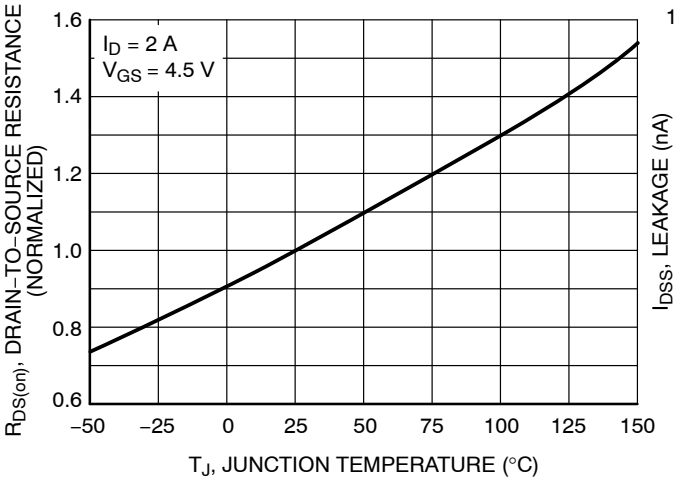



**Figure 5. On−Resistance Variation with Temperature**

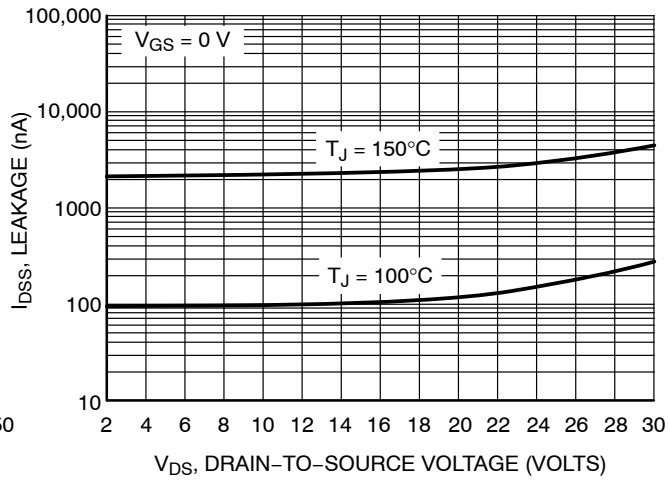



**Figure 6. Drain−to−Source Leakage Current versus Voltage**

## TYPICAL PERFORMANCE CURVES ($T_J$ = 25°C unless otherwise noted)

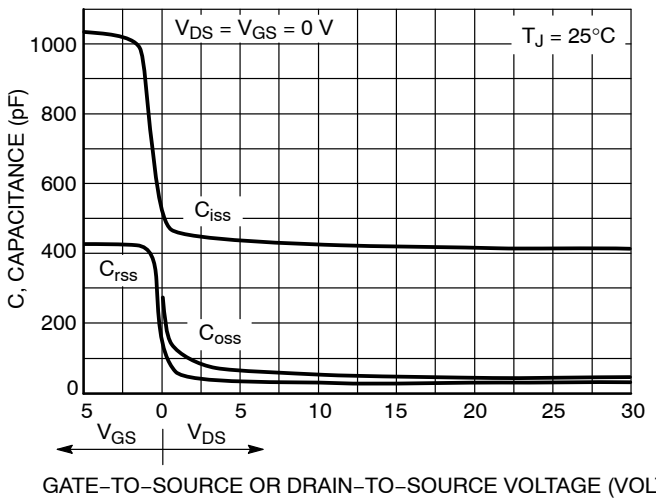



**Figure 7. Capacitance Variation**

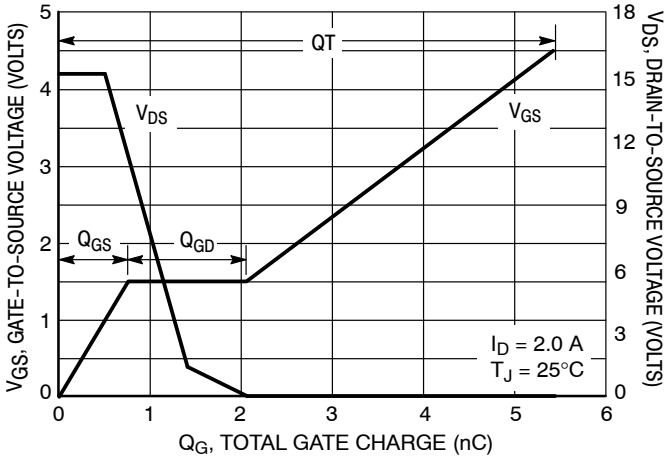



**Figure 8. Gate−To−Source and Drain−To−Source Voltage versus Total Charge**

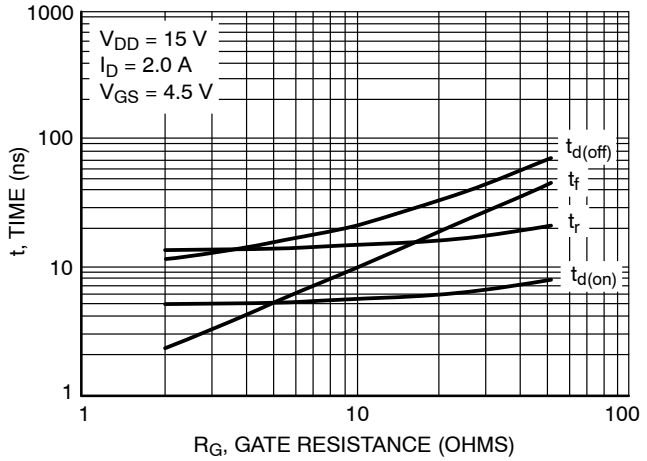



**Figure 9. Resistive Switching Time Variation versus Gate Resistance**

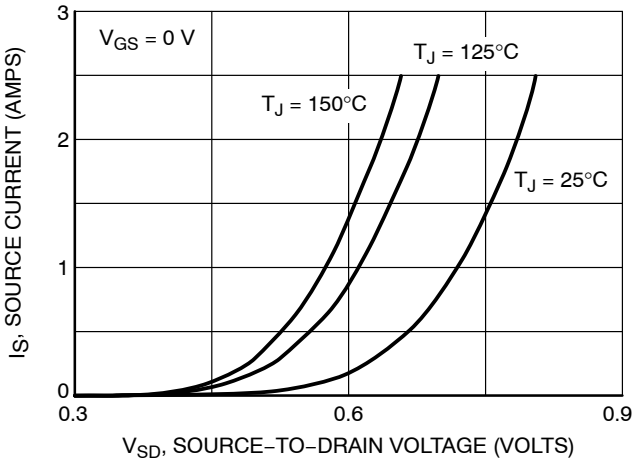



**Figure 10. Diode Forward Voltage versus Current**

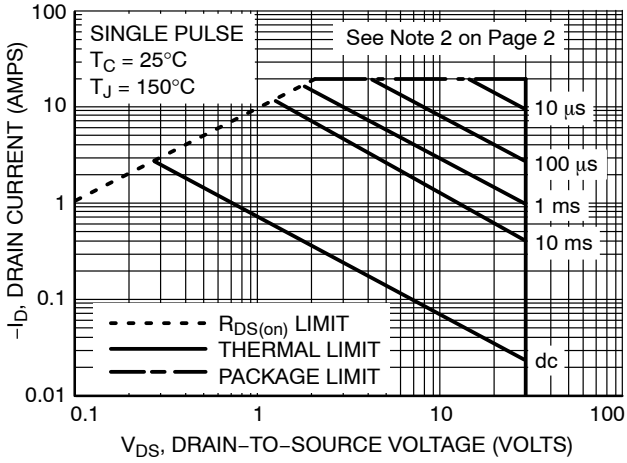



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**

**TYPICAL PERFORMANCE CURVES** ($T_J$ = 25°C unless otherwise noted)

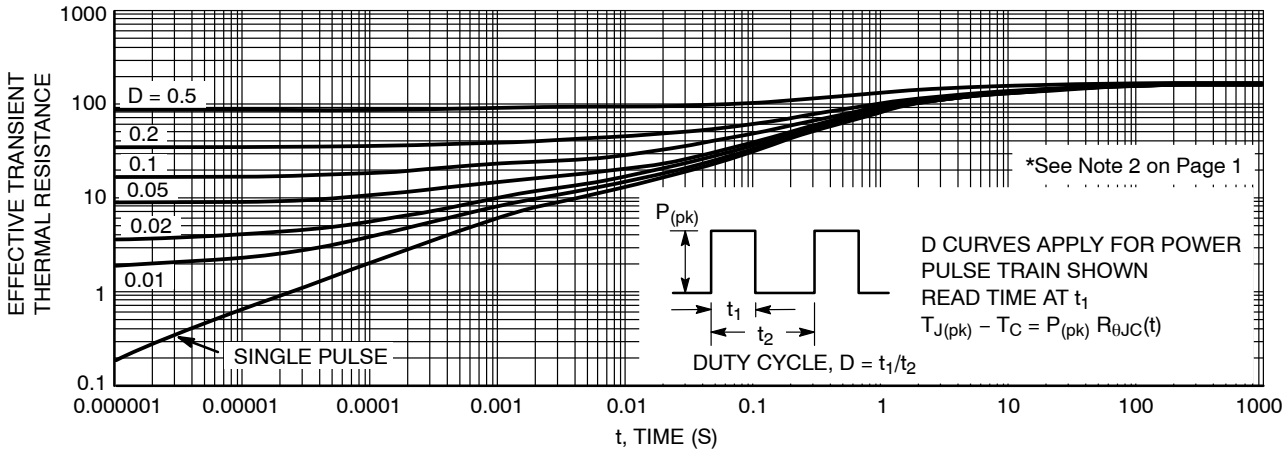



**Figure 12. Thermal Response**

## TYPICAL SCHOTTKY PERFORMANCE CURVES ($T_J$ = 25°C unless otherwise noted)

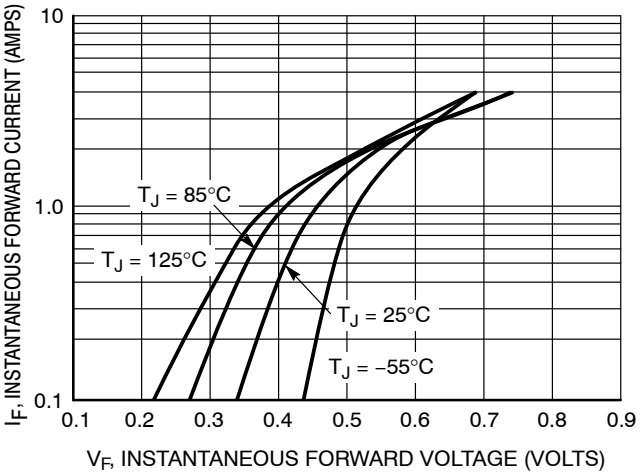



**Figure 13. Typical Forward Voltage**

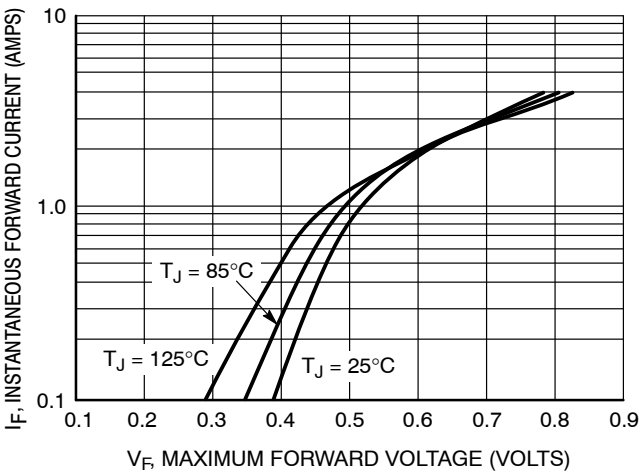



**Figure 14. Maximum Forward Voltage**

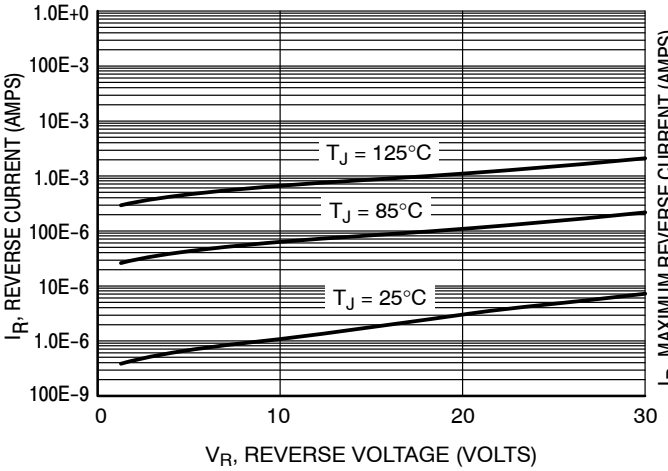



**Figure 15. Typical Reverse Current**

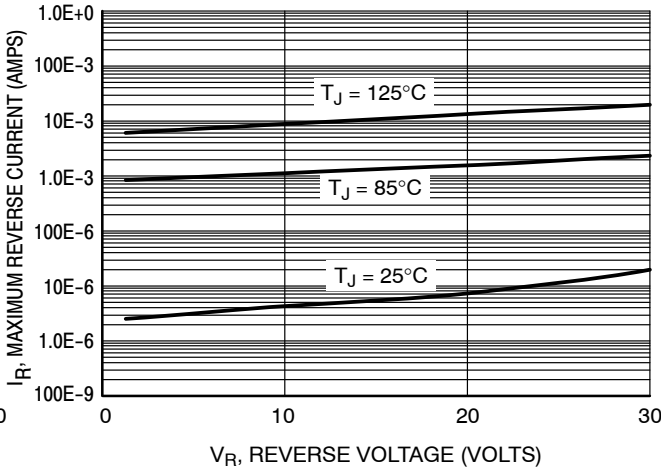


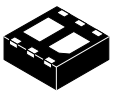

**Figure 16. Maximum Reverse Current**

### ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| NTLJF4156NT1G | WDFN6<br>(Pb−Free) | 3000 / Tape & Reel |
| NTLJF4156NTAG | WDFN6<br>(Pb−Free) | 3000 / Tape & Reel |

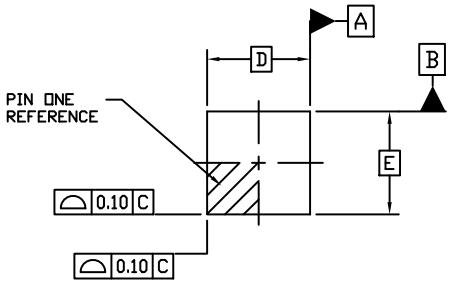
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS



**WDFN6 2x2, 0.65P**
CASE 506AN
ISSUE H

DATE 25 JAN 2022

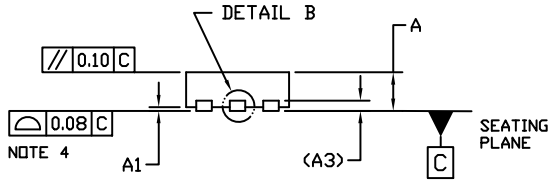



TOP VIEW

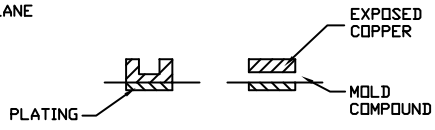

DETAIL A
OPTIONAL CONSTRUCTIONS

NOTES:

1. DIMENSIONING AND TOLERANCING PER. ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.

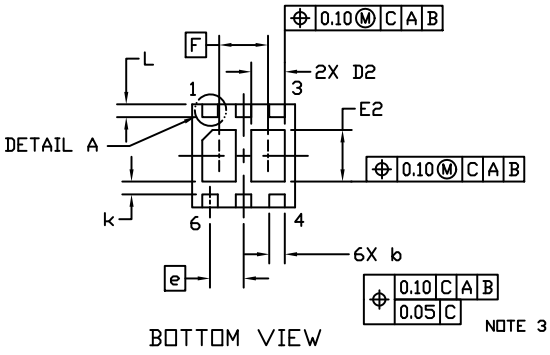



SIDE VIEW

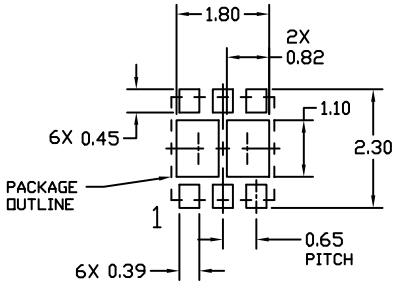



DETAIL B
OPTIONAL CONSTRUCTIONS

| DIM | MILLIMETERS | |
|---|---|---|
| | MIN. | MAX. |
| A | 0.70 | 0.80 |
| A1 | 0.00 | 0.05 |
| A3 | 0.20 REF | |
| b | 0.25 | 0.35 |
| D | 2.00 BSC | |
| D2 | 0.57 | 0.77 |
| E | 2.00 BSC | |
| E2 | 0.90 | 1.10 |
| e | 0.65 BSC | |
| F | 0.95 BSC | |
| k | 0.25 REF | |
| L | 0.20 | 0.30 |
| L1 | --- | 0.10 |




BOTTOM VIEW




RECOMMENDED
MOUNTING FOOTPRINT
SOLDERMASK DEFINED

### GENERIC MARKING DIAGRAM*


XX = Specific Device Code
M = Date Code

*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:** | **98AON20861D** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. | |
| **DESCRIPTION:** | **WDFN6 2x2, 0.65P** | | **PAGE 1 OF 1** |

## PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT**:
**Email Requests to:** orderlit@onsemi.com

**onsemi Website:** www.onsemi.com

**TECHNICAL SUPPORT**
**North American Technical Support:**
Voice Mail: 1 800−282−9855 Toll Free USA/Canada
Phone: 011 421 33 790 2910

**Europe, Middle East and Africa Technical Support:**
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative

◊