# NTLUS3A39PZC

# Power MOSFET

## −20 V, −5.2 A, Single P−Channel, ESD, 1.6x1.6x0.55 mm UDFN μCool™ Package

### Features

- UDFN Package with Exposed Drain Pads for Excellent Thermal Conduction
- Low Profile UDFN 1.6 x 1.6 x 0.55 mm for Board Space Saving
- Ultra Low $R_{DS(on)}$
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

- Optimized for Power Management Applications for Portable Products, Such as Cell Phones, PMP, Media Tablets, DSC, GPS, and Others
- Battery Switch
- High Side Load Switch

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

| Parameter | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain-to-Source Voltage | | | $V_{DSS}$ | −20 | V |
| Gate-to-Source Voltage | | | $V_{GS}$ | ±8.0 | V |
| Continuous Drain Current (Note 1) | Steady State | $T_A$ = 25°C | $I_D$ | −5.2 | A |
| Continuous Drain Current (Note 1) | Steady State | $T_A$ = 85°C | | −3.7 | |
| Continuous Drain Current (Note 1) | t ≤ 5 s | $T_A$ = 25°C | | −6.4 | |
| Power Dissipation (Note 1) | Steady State | $T_A$ = 25°C | $P_D$ | 1.5 | W |
| Power Dissipation (Note 1) | t ≤ 5 s | $T_A$ = 25°C | | 2.3 | |
| Continuous Drain Current (Note 2) | Steady State | $T_A$ = 25°C | $I_D$ | −3.4 | A |
| Continuous Drain Current (Note 2) | Steady State | $T_A$ = 85°C | | −2.4 | |
| Power Dissipation (Note 2) | | $T_A$ = 25°C | $P_D$ | 0.6 | W |
| Pulsed Drain Current | | tp = 10 μs | $I_{DM}$ | −17 | A |
| Operating Junction and Storage Temperature | | | $T_J$, $T_{STG}$ | -55 to 150 | °C |
| Source Current (Body Diode) (Note 2) | | | $I_S$ | −1 | A |
| 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.

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

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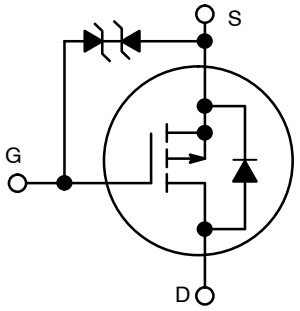
**MOSFET**

| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|---|---|---|
| −20 V | 39 mΩ @ −4.5 V | −5.2 A |
| | 50 mΩ @ −2.5 V | |
| | 81 mΩ @ −1.8 V | |
| | 147 mΩ @ −1.5 V | |




**P−Channel MOSFET**

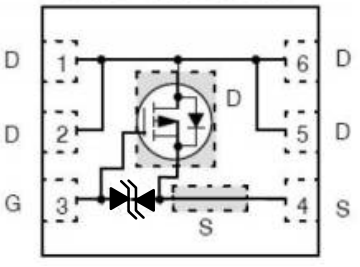
**MARKING DIAGRAM**


**UDFN6**
**(μCOOL™)**
**CASE 517AU**


AF = 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 5 of this data sheet.

**THERMAL RESISTANCE RATINGS**

| Parameter | Symbol | Max | Unit |
|---|---|---|---|
| Junction-to-Ambient – Steady State (Note 3) | $R_{\theta JA}$ | 85 | °C/W |
| Junction-to-Ambient – t ≤ 5 s (Note 3) | $R_{\theta JA}$ | 55 | |
| Junction-to-Ambient – Steady State min Pad (Note 4) | $R_{\theta JA}$ | 200 | |

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.

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

| Parameter | Symbol | Test Condition | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = −250 μA | | −20 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $I_D$ = −250 μA, ref to 25°C | | | 13 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = −20 V | $T_J$ = 25°C | | | −1.0 | μA |
| Gate-to-Source Leakage Current | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±8.0 V | | | | ±10 | μA |
| **ON CHARACTERISTICS** (Note 5) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = −250 μA | | −0.4 | | −1.0 | V |
| Negative Threshold Temp. Coefficient | $V_{GS(TH)}/T_J$ | | | | 3.0 | | mV/°C |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = −4.5 V, $I_D$ = −4.0 A | | | 30 | 39 | mΩ |
| | | $V_{GS}$ = −2.5 V, $I_D$ = −2.0 A | | | 40 | 50 | |
| | | $V_{GS}$ = −1.8 V, $I_D$ = −1.2 A | | | 55 | 81 | |
| | | $V_{GS}$ = −1.5 V, $I_D$ = −0.5 A | | | 75 | 147 | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = −5 V, $I_D$ = −3.0 A | | | 25 | | S |
| **CHARGES, CAPACITANCES & GATE RESISTANCE** | | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 1 MHz, $V_{DS}$ = −15 V | | | 920 | | pF |
| Output Capacitance | $C_{OSS}$ | | | | 85 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | | 80 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = −4.5 V, $V_{DS}$ = −15 V; $I_D$ = −3.0 A | | | 10.4 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | | 0.5 | | |
| Gate-to-Source Charge | $Q_{GS}$ | | | | 1.2 | | |
| Gate-to-Drain Charge | $Q_{GD}$ | | | | 3.0 | | |
| **SWITCHING CHARACTERISTICS, VGS = 4.5 V** (Note 6) | | | | | | | |
| Turn-On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = −4.5 V, $V_{DD}$ = −15 V, $I_D$ = −3.0 A, $R_G$ = 1 Ω | | | 7.2 | | ns |
| Rise Time | $t_r$ | | | | 12.2 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | | 34.7 | | |
| Fall Time | $t_f$ | | | | 34.8 | | |
| **DRAIN-SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = −1.0 A | $T_J$ = 25°C | | 0.67 | 1.0 | V |
| | | | $T_J$ = 125°C | | 0.56 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, dis/dt = 100 A/μs, $I_S$ = −1.0 A | | | 11.1 | | ns |
| Charge Time | $t_a$ | | | | 5.8 | | |
| Discharge Time | $t_b$ | | | | 5.3 | | |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 4 | | nC |

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

## TYPICAL CHARACTERISTICS

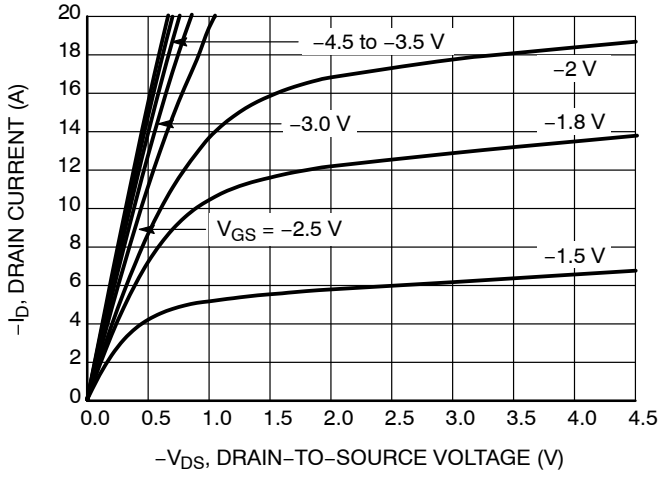



**Figure 1. On−Region Characteristics**

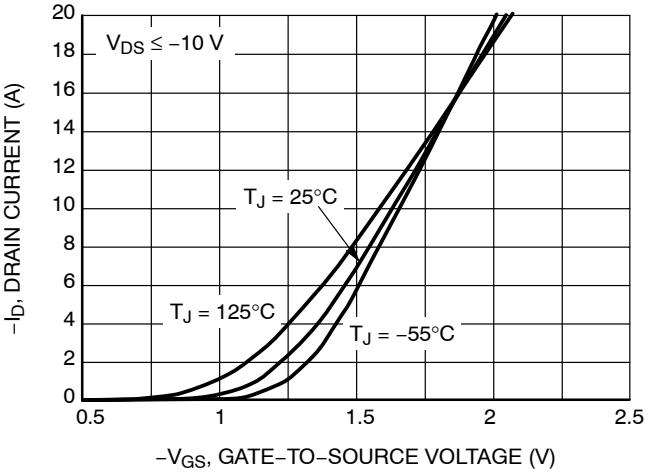



**Figure 2. Transfer Characteristics**

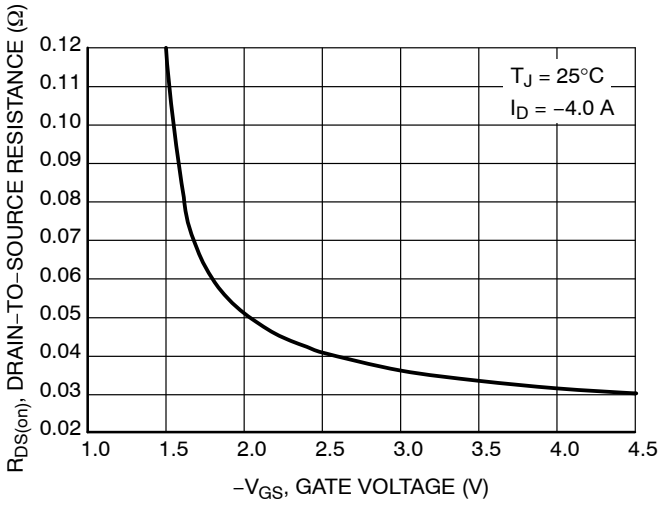



**Figure 3. On−Resistance vs. Gate−to−Source Voltage**

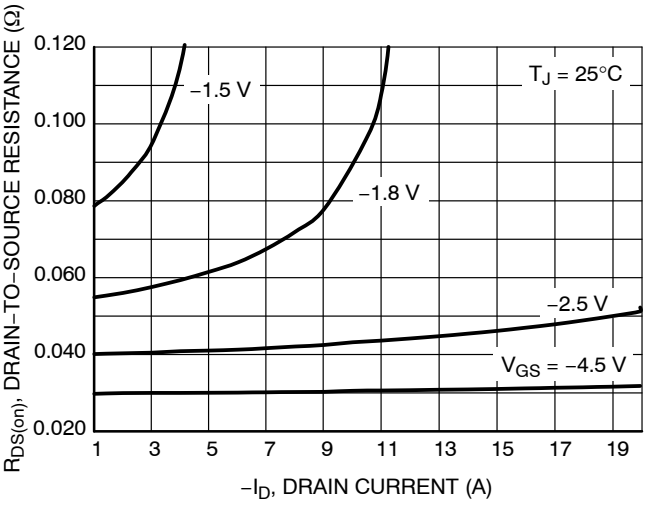



**Figure 4. On−Resistance vs. Drain Current and Gate Voltage**

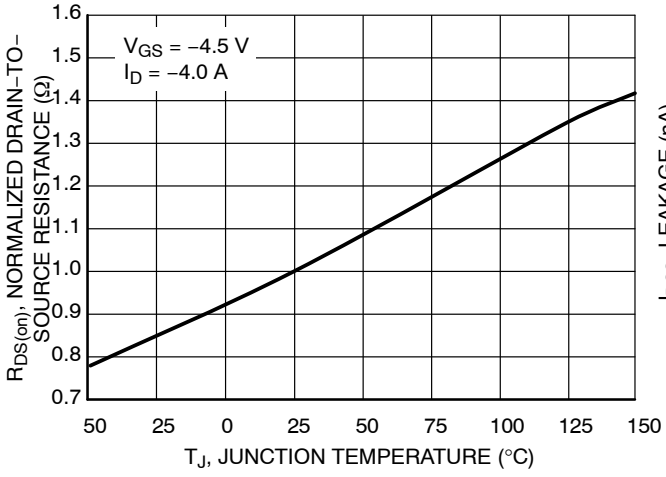



**Figure 5. On−Resistance Variation with Temperature**

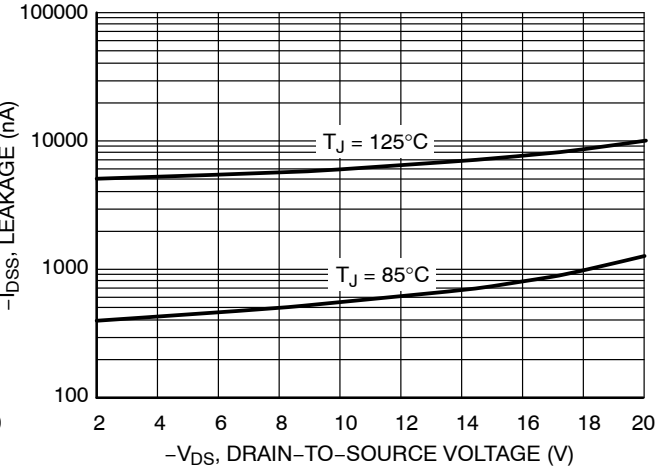



**Figure 6. Drain−to−Source Leakage Current vs. Voltage**

## TYPICAL CHARACTERISTICS

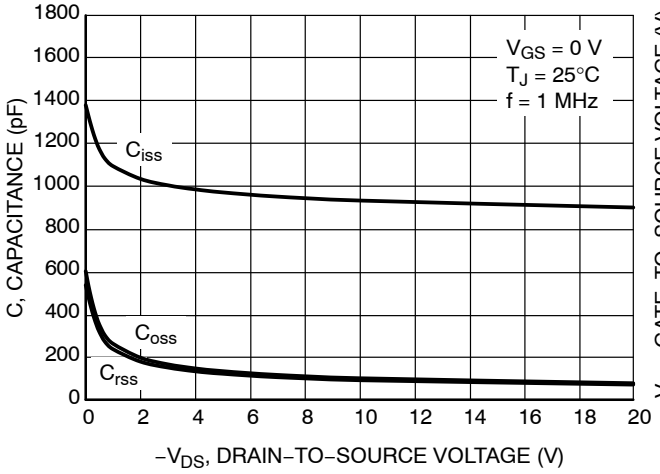



**Figure 7. Capacitance Variation**

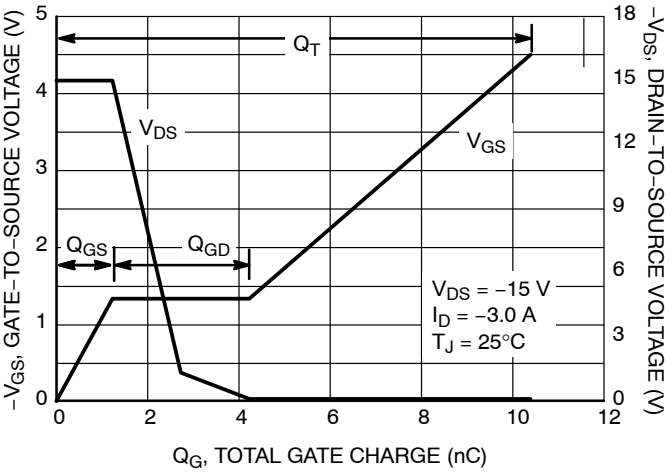



**Figure 8. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge**

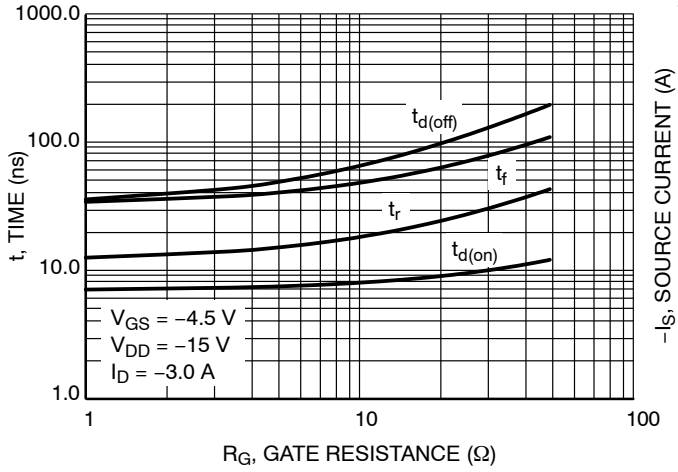



**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**

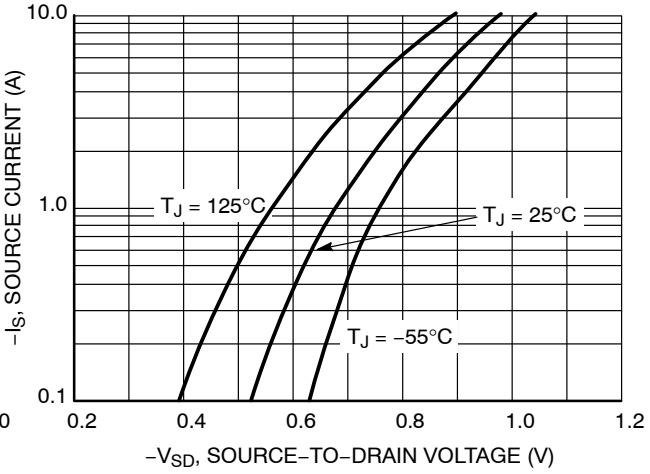



**Figure 10. Diode Forward Voltage vs. Current**

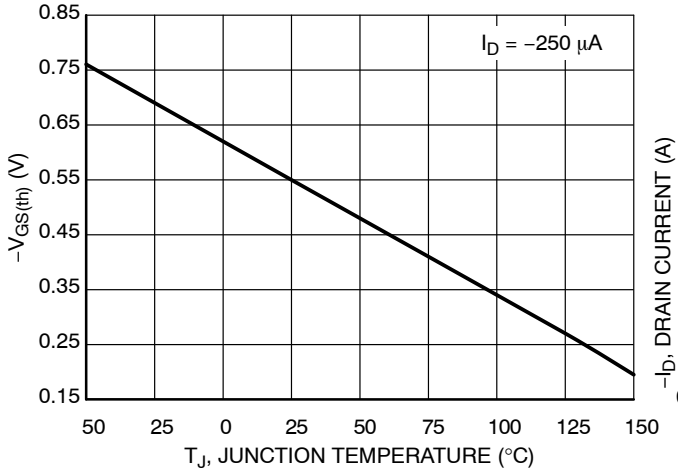



**Figure 11. Threshold Voltage**

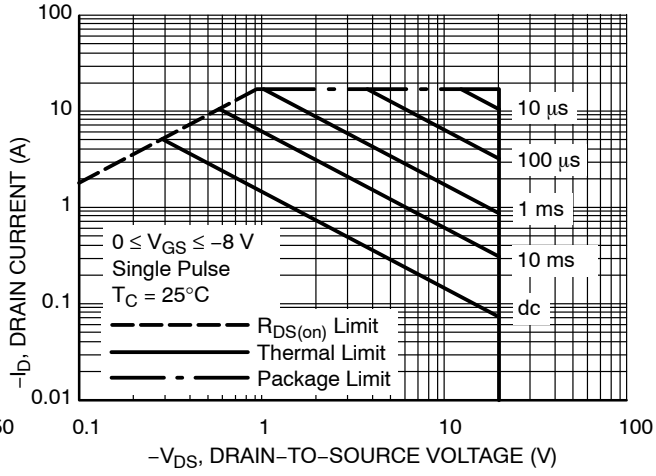



**Figure 12. Maximum Rated Forward Biased Safe Operating Area**

## TYPICAL CHARACTERISTICS

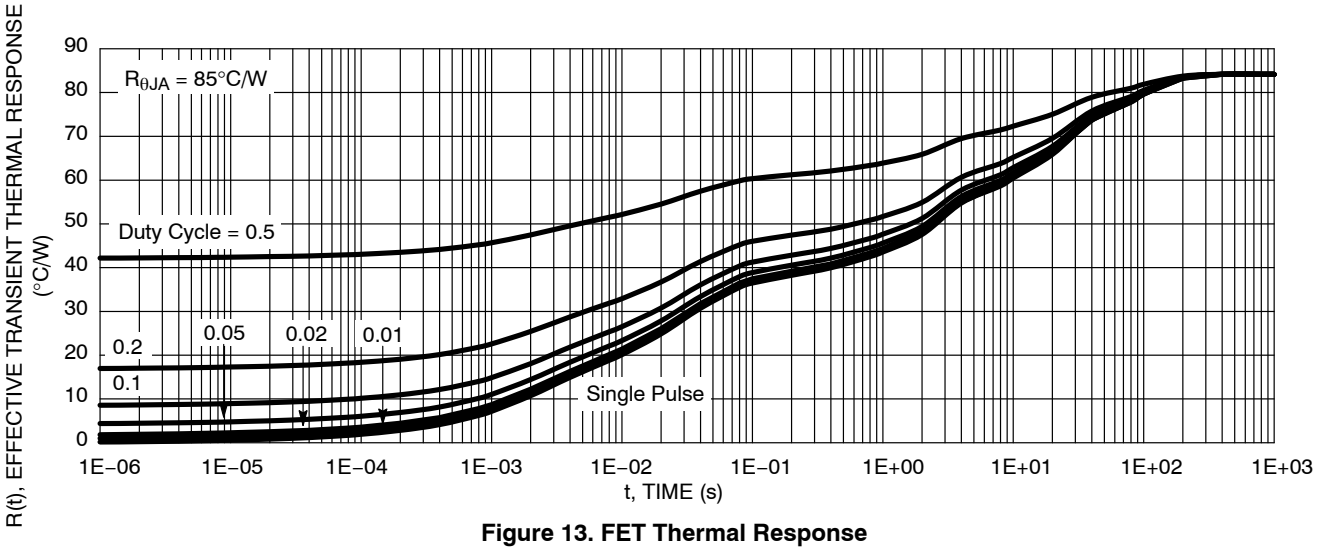



**Figure 13. FET Thermal Response**

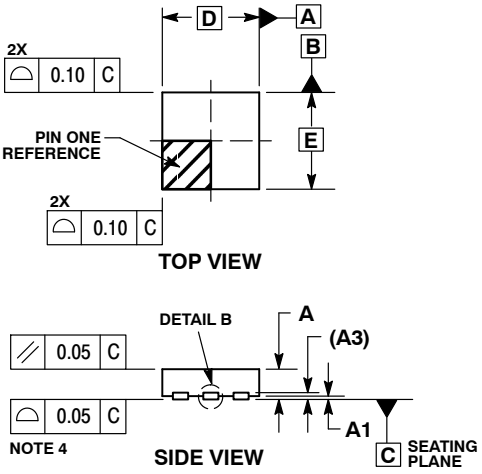
### DEVICE ORDERING INFORMATION

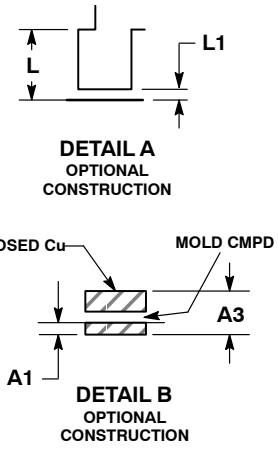
| Device | Package | Shipping† |
|---|---|---|
| NTLUS3A39PZCTAG | UDFN6<br>(Pb−Free) | 3000 / Tape & Reel |
| NTLUS3A39PZCTBG | UDFN6<br>(Pb−Free) | 3000 / Tape & Reel |

†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.

## PACKAGE DIMENSIONS

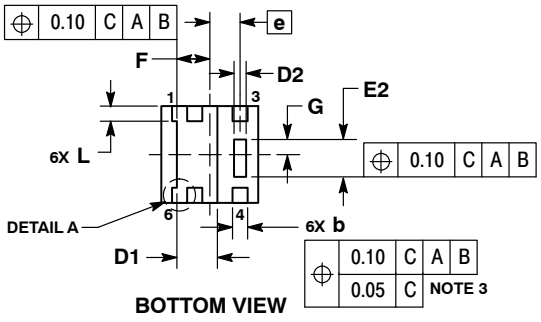
**UDFN6 1.6x1.6, 0.5P**
CASE 517AU
ISSUE O



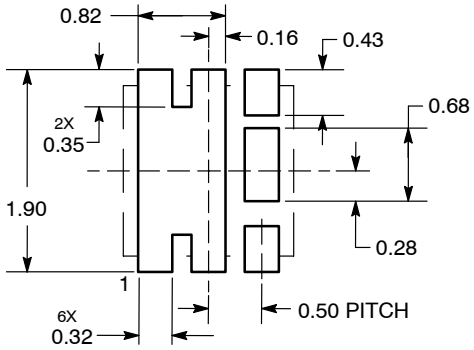




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

| | MILLIMETERS | |
|---|---|---|
| DIM | MIN | MAX |
| A | 0.45 | 0.55 |
| A1 | 0.00 | 0.05 |
| A3 | 0.13 REF | |
| b | 0.20 | 0.30 |
| D | 1.60 BSC | |
| E | 1.60 BSC | |
| e | 0.50 BSC | |
| D1 | 0.62 | 0.72 |
| D2 | 0.15 | 0.25 |
| E2 | 0.57 | 0.67 |
| F | 0.55 BSC | |
| G | 0.25 BSC | |
| L | 0.20 | 0.30 |
| L1 | --- | 0.15 |




### SOLDERMASK DEFINED MOUNTING FOOTPRINT*




DIMENSIONS: MILLIMETERS

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



**PUBLICATION ORDERING INFORMATION**

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