# NTLUS4C16N

# MOSFET – Power, Single, N-Channel, μCool, UDFN6, 1.6x1.6x0.55 mm
## 30 V, 11.7 A

### 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
- Power Load Switch
- Wireless Charging
- DC−DC Converters

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

| Parameter | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain-to-Source Voltage | | | $V_{DSS}$ | 30 | V |
| Gate-to-Source Voltage | | | $V_{GS}$ | ±12 | V |
| Continuous Drain Current (Note 1) | Steady State | $T_A$ = 25°C | $I_D$ | 9.4 | A |
| | | $T_A$ = 85°C | | 6.8 | |
| | t ≤ 5 s | $T_A$ = 25°C | | 11.7 | |
| Power Dissipation (Note 1) | Steady State | $T_A$ = 25°C | $P_D$ | 1.53 | W |
| | t ≤ 5 s | $T_A$ = 25°C | | 2.37 | |
| Continuous Drain Current (Note 2) | Steady State | $T_A$ = 25°C | $I_D$ | 6.1 | A |
| | | $T_A$ = 85°C | | 4.4 | |
| Power Dissipation (Note 2) | | $T_A$ = 25°C | $P_D$ | 0.65 | W |
| Pulsed Drain Current | | $t_p$ = 10 μs | $I_{DM}$ | 28 | A |
| MOSFET Operating Junction and Storage Temperature | | | $T_J$, $T_{STG}$ | -55 to 150 | °C |
| Source Current (Body Diode) (Note 1) | | | $I_S$ | 2.0 | A |
| 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.
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, 2 oz. Cu.

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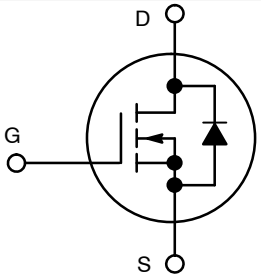
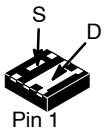
**MOSFET**

| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|---|---|---|
| 30 V | 11.4 mΩ @ 10 V | 11.7 A |
| | 13.3 mΩ @ 4.5 V | |
| | 14.2 mΩ @ 3.7 V | |
| | 15.2 mΩ @ 3.3 V | |
| | 20 mΩ @ 2.5 V | |
| | 40 mΩ @ 1.8 V | |




**N−CHANNEL MOSFET**

**MARKING DIAGRAM**

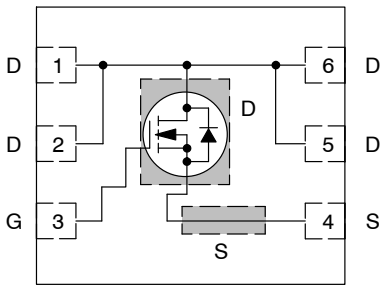



**UDFN6**
**(μCOOL™)**
**CASE 517AU**


AH = 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 on page 3 of this data sheet.

**THERMAL RESISTANCE RATINGS**

| Parameter | Symbol | Max | Unit |
|---|---|---|---|
| Junction-to-Ambient – Steady State (Note 3) | $R_{\theta JA}$ | 81.7 | °C/W |
| Junction-to-Ambient – t ≤ 5 s (Note 3) | $R_{\theta JA}$ | 52.8 | |
| Junction-to-Ambient – Steady State min Pad (Note 4) | $R_{\theta JA}$ | 193.6 | |

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, 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 | | 30 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $I_D$ = 250 μA, ref to 25°C | | | 11 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 24 V | $T_J$ = 25°C | | | 1 | μA |
| | | | $T_J$ = 125°C | | | 10 | |
| Gate-to-Source Leakage Current | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±12 V | | | | ±100 | nA |
| **ON CHARACTERISTICS** (Note 5) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | | 0.6 | | 1.1 | V |
| Negative Threshold Temp. Coefficient | $V_{GS(TH)}/T_J$ | | | | 3 | | mV/°C |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 8.0 A | | | 9.3 | 11.4 | mΩ |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 5.0 A | | | 10.7 | 13.3 | |
| | | $V_{GS}$ = 3.7 V, $I_D$ = 3.0 A | | | 11.4 | 14.2 | |
| | | $V_{GS}$ = 3.3 V, $I_D$ = 3.0 A | | | 12.0 | 15.2 | |
| | | $V_{GS}$ = 2.5 V, $I_D$ = 2.5 A | | | 14.3 | 20 | |
| | | $V_{GS}$ = 1.8 V, $I_D$ = 2.5 A | | | 26 | 40 | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 1.5 V, $I_D$ = 5.0 A | | | 31 | | S |
| **CHARGES, CAPACITANCES & GATE RESISTANCE** | | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 1 MHz, $V_{DS}$ = 15 V | | | 690 | | pF |
| Output Capacitance | $C_{OSS}$ | | | | 305 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | | 26 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 15 V; $I_D$ = 5.0 A | | | 7.5 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | | 0.6 | | |
| Gate-to-Source Charge | $Q_{GS}$ | | | | 1.3 | | |
| Gate-to-Drain Charge | $Q_{GD}$ | | | | 1.4 | | |
| **SWITCHING CHARACTERISTICS, $V_{GS}$ = 4.5 V** (Note 6) | | | | | | | |
| Turn-On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = 4.5 V, $V_{DD}$ = 15 V, $I_D$ = 5.0 A, $R_G$ = 1 Ω | | | 6.0 | | ns |
| Rise Time | $t_r$ | | | | 14.5 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | | 17.5 | | |
| Fall Time | $t_f$ | | | | 2.5 | | |
| **DRAIN-SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = 2.0 A | $T_J$ = 25°C | | 0.7 | 1.0 | V |
| | | | $T_J$ = 125°C | | 0.5 | | |

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.

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

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **DRAIN-SOURCE DIODE CHARACTERISTICS** | | | | | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, dIs/dt = 100 A/μs, $I_S$ = 2.0 A | | 21 | | ns |
| Charge Time | $t_a$ | | | 11 | | |
| Discharge Time | $t_b$ | | | 10 | | |
| Reverse Recovery Charge | $Q_{RR}$ | | | 10.5 | | 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.

**DEVICE ORDERING INFORMATION**

| Device | Package | Shipping† |
|---|---|---|
| NTLUS4C16NTAG | UDFN6 (Pb−Free) | 3000 / Tape & Reel |
| NTLUS4C16NTBG | UDFN6 (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.

## TYPICAL CHARACTERISTICS

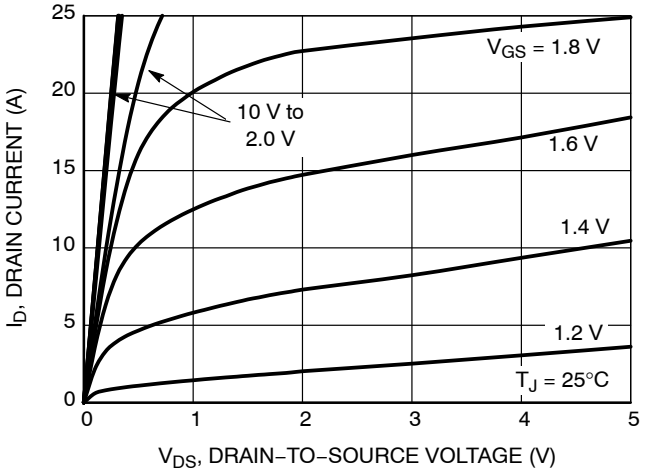



**Figure 1. On−Region Characteristics**

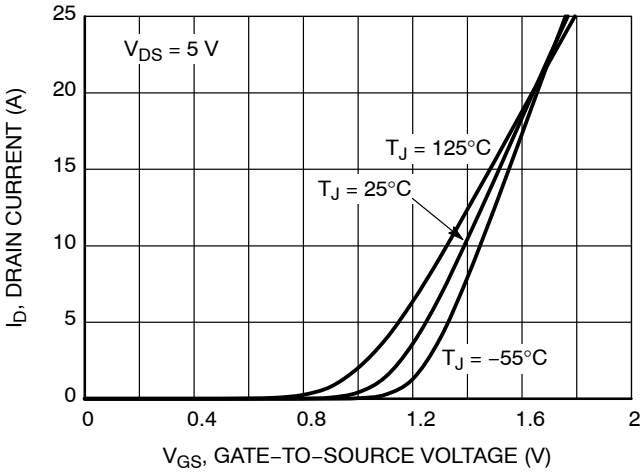



**Figure 2. Transfer Characteristics**

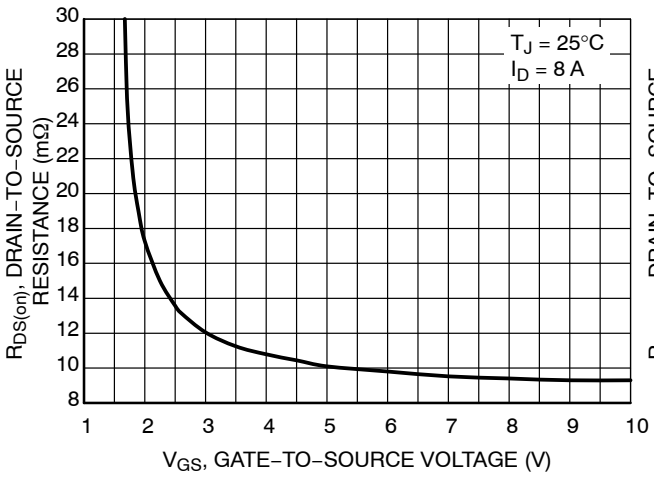



**Figure 3. On−Resistance vs. Gate−to−Source Voltage**

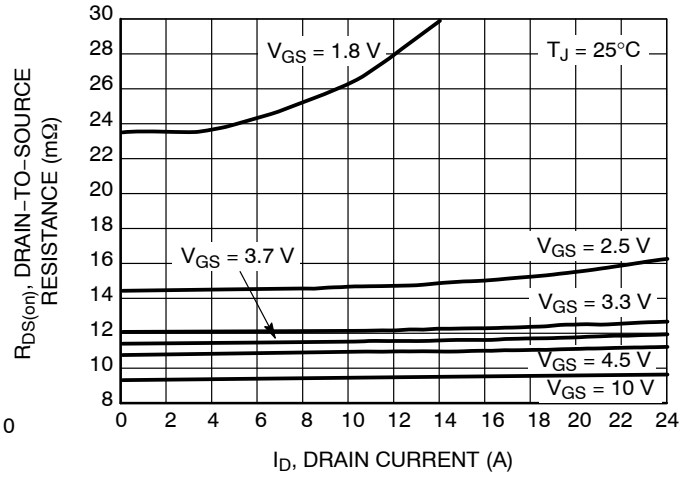



**Figure 4. On−Resistance vs. Drain Current and Gate Voltage**

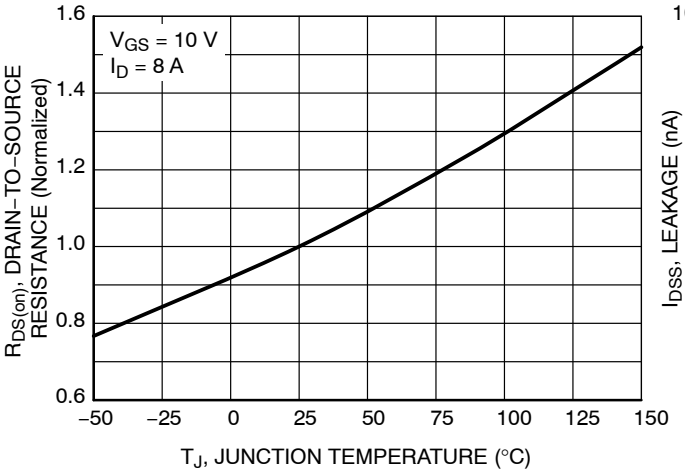



**Figure 5. On−Resistance Variation with Temperature**

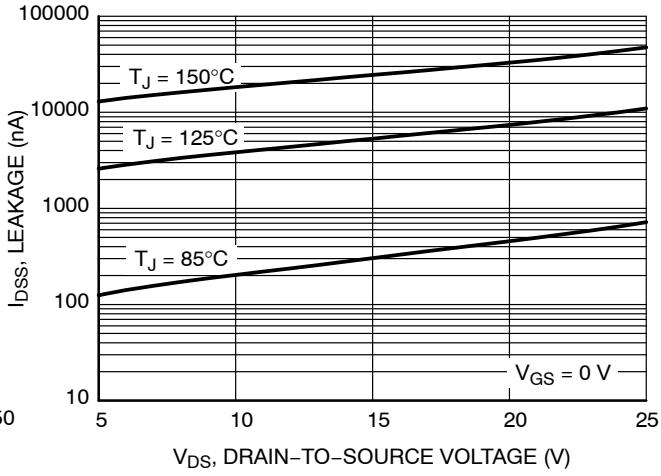



**Figure 6. Drain−to−Source Leakage Current vs. Voltage**

## TYPICAL CHARACTERISTICS

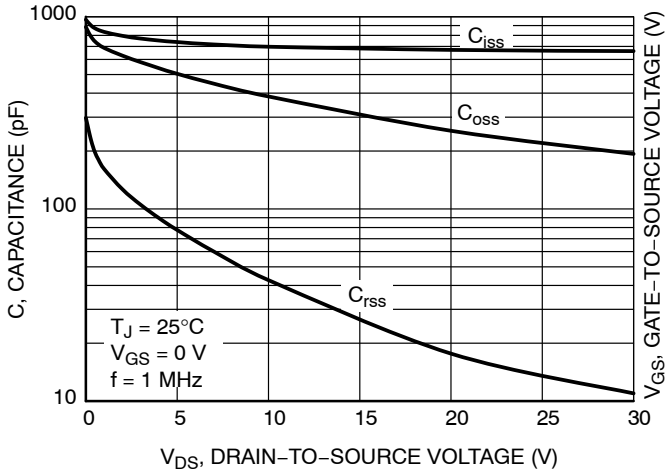



**Figure 7. Capacitance Variation**

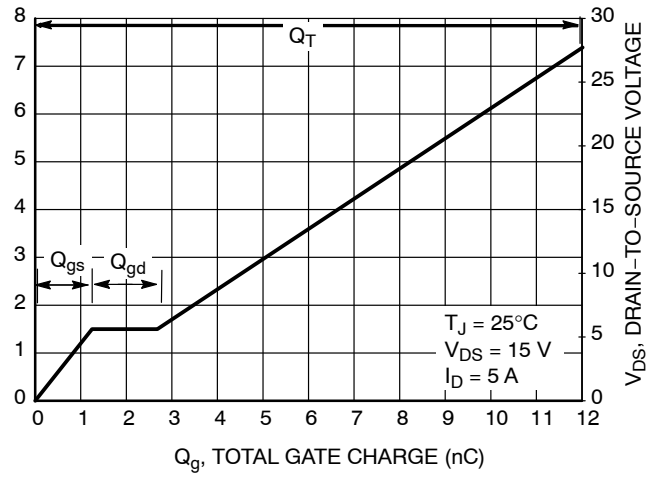



**Figure 8. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge**

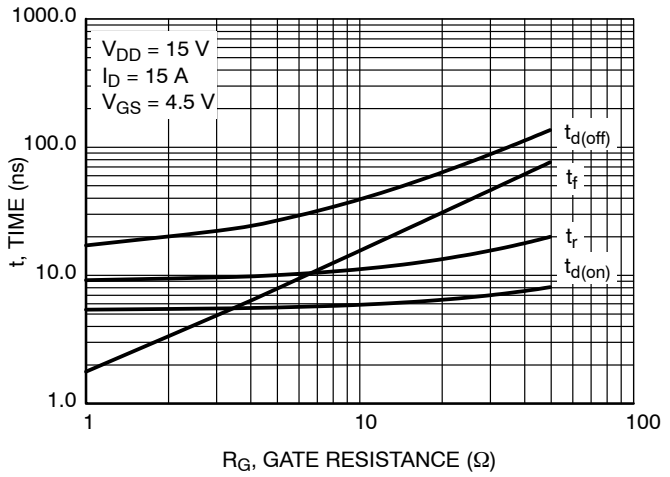



**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**

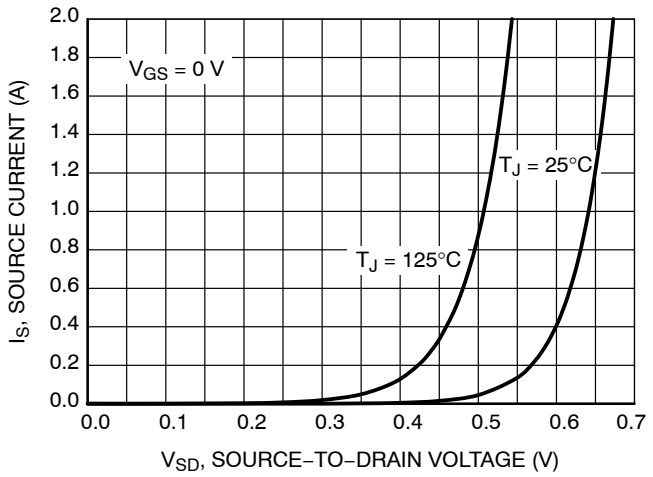



**Figure 10. Diode Forward Voltage vs. Current**

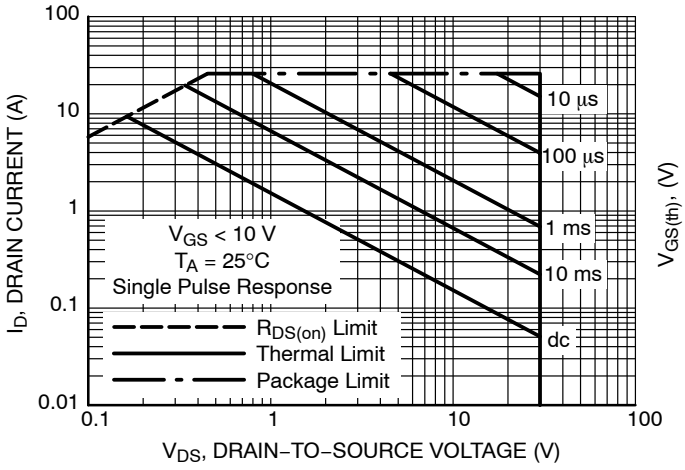



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**

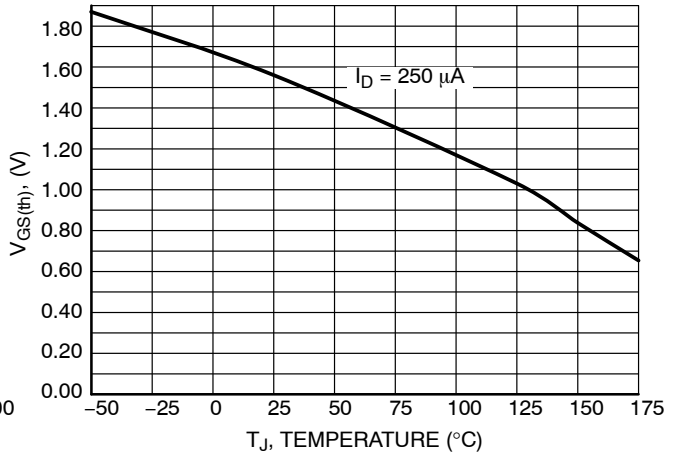



**Figure 12. $V_{GS(th)}$ vs. Temperature**

## TYPICAL CHARACTERISTICS

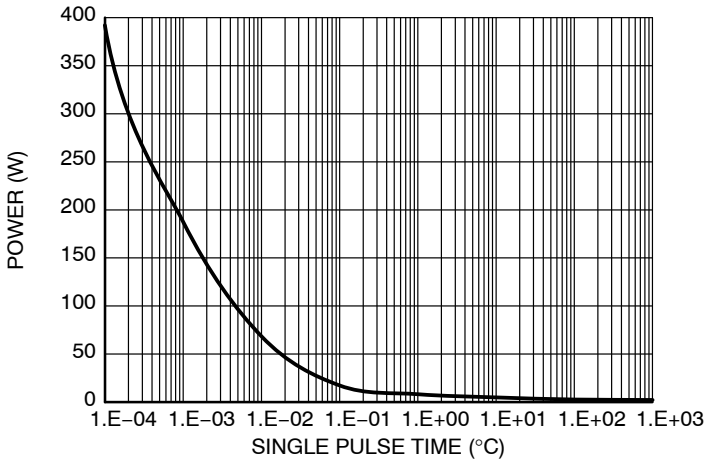



**Figure 13. Single Pulse Maximum Power Dissipation**

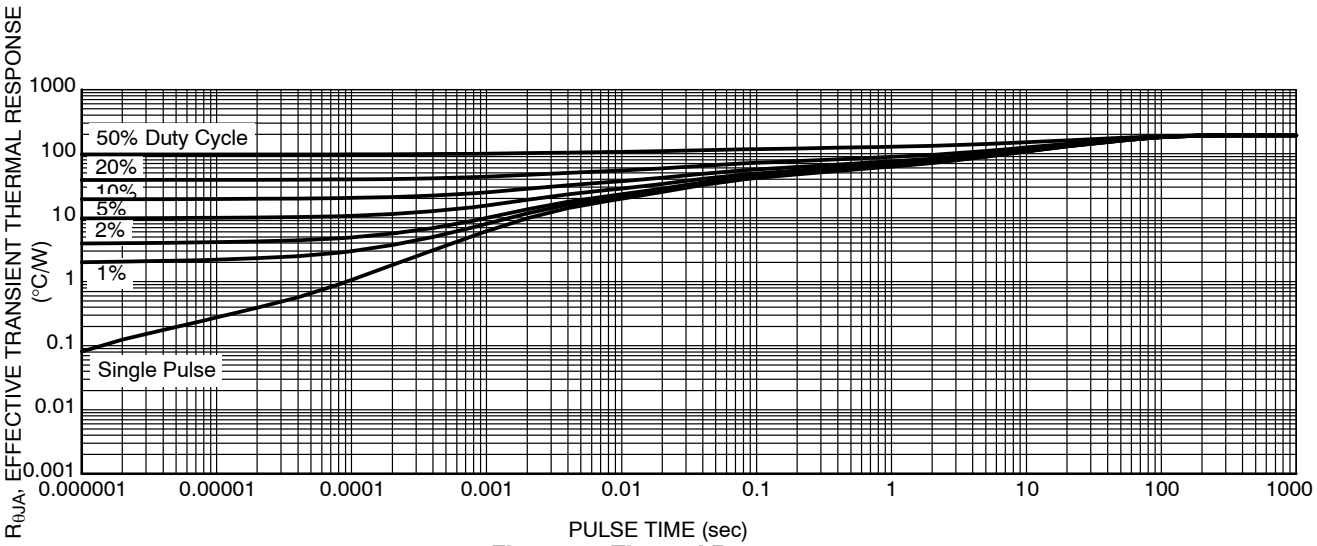
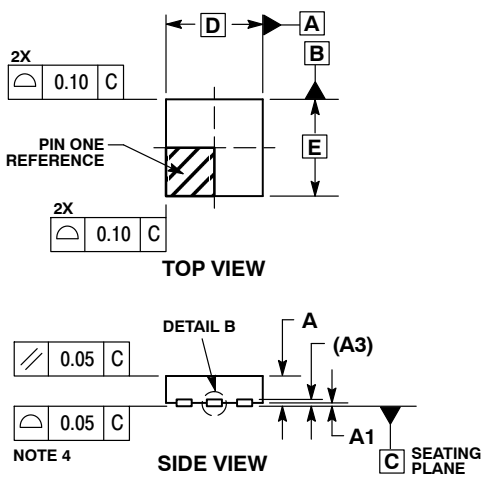
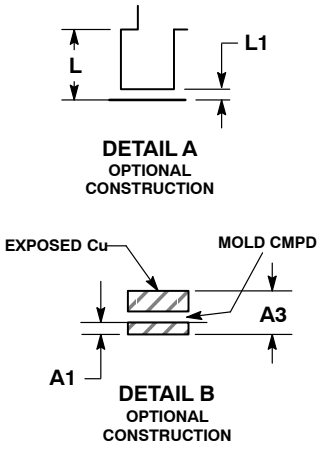



**Figure 14. Thermal Response**

## PACKAGE DIMENSIONS

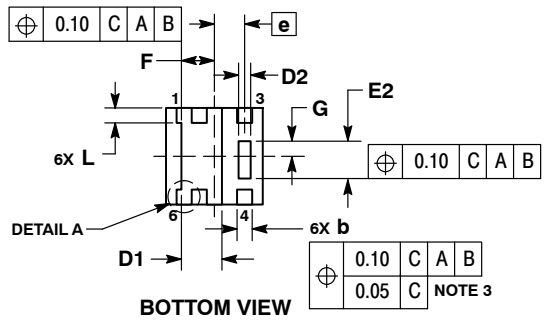
**UDFN6 1.6x1.6, 0.5P**
CASE 517AU
ISSUE O



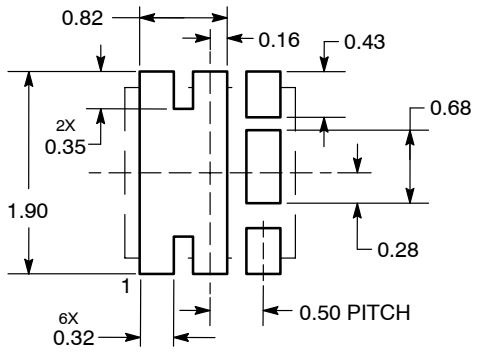




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

| | 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.



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