

# MOSFET – Power, Complementary, WDFN

## 2X2 mm

### 20 V/-20 V, 4.6 A/-4.1 A

## NTLJD3119C

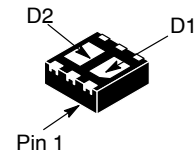
#### Features

- Complementary N-Channel and P-Channel MOSFET
- WDFN Package with Exposed Drain Pad for Excellent Thermal Conduction
- Footprint Same as SC-88 Package
- Leading Edge Trench Technology for Low On Resistance
- 1.8 V Gate Threshold Voltage
- Low Profile (< 0.8 mm) for Easy Fit in Thin Environments
- This is a Pb-Free Device

#### Applications

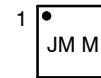
- Synchronous DC-DC Conversion Circuits
- Load/Power Management of Portable Devices like PDA's, Cellular Phones and Hard Drives
- Color Display and Camera Flash Regulators

| $V_{(BR)DSS}$      | $R_{DS(on) MAX}$ | $I_D MAX$ |
|--------------------|------------------|-----------|
| N-Channel<br>20 V  | 65 mΩ @ 4.5 V    | 3.8 A     |
|                    | 85 mΩ @ 2.5 V    | 2.0 A     |
|                    | 120 mΩ @ 1.8 V   | 1.7 A     |
| P-Channel<br>-20 V | 100 mΩ @ -4.5 V  | -4.1 A    |
|                    | 135 mΩ @ -2.5 V  | -2.0 A    |
|                    | 200 mΩ @ -1.8 V  | -1.6 A    |



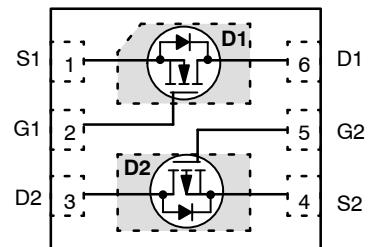
**WDFN6  
CASE 506AN**

#### MARKING DIAGRAM



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

#### PIN CONNECTIONS



(Top View)

#### ORDERING INFORMATION

| Device        | Package            | Shipping†        |
|---------------|--------------------|------------------|
| NTLJD3119CTBG | 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 Specification Brochure, BRD8011/D.

# NTLJD3119C

## MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise noted)

| Parameter   |              |                        | Symbol                            | Value      | Unit |
|---|--------------|------------------------|-----------------------------------|------------|------|
| Drain-to-Source Voltage   | N-Ch         |                        | V <sub>DSS</sub>                  | 20         | V    |
|   | P-Ch         |                        |                                   | -20        |      |
| Gate-to-Source Voltage  | N-Ch         |                        | V <sub>GS</sub>                   | ±8.0       | V    |
|   | P-Ch         |                        |                                   |            |      |
| <b>N-Channel</b><br>Continuous Drain Current (Note 1)             | Steady State | T <sub>A</sub> = 25°C  | I <sub>D</sub>                    | 3.8        | A    |
|   |              | T <sub>A</sub> = 85°C  |                                   | 2.8        |      |
|   | t ≤ 5 s      | T <sub>A</sub> = 25°C  | 4.6                               |            |      |
| <b>P-Channel</b><br>Continuous Drain Current (Note 1)             | Steady State | T <sub>A</sub> = 25°C  | I <sub>D</sub>                    | -3.3       | A    |
|   |              | T <sub>A</sub> = 85°C  |                                   | -2.4       |      |
|   | t ≤ 5 s      | T <sub>A</sub> = 25°C  | -4.1                              |            |      |
| Power Dissipation (Note 1)  | Steady State | T <sub>A</sub> = 25°C  | P <sub>D</sub>                    | 1.5        | W    |
|   | t ≤ 5 s      |                        |                                   | 2.3        |      |
| <b>N-Channel</b><br>Continuous Drain Current (Note 2)             | Steady State | T <sub>A</sub> = 25°C  | I <sub>D</sub>                    | 2.6        | A    |
|   |              | T <sub>A</sub> = 85°C  |                                   | 1.9        |      |
| <b>P-Channel</b><br>Continuous Drain Current (Note 2)             | Steady State | T <sub>A</sub> = 25°C  | I <sub>D</sub>                    | -2.3       | A    |
|   |              | T <sub>A</sub> = 85°C  |                                   | -1.6       |      |
| Power Dissipation (Note 2)  | Steady State | T <sub>A</sub> = 25°C  | P <sub>D</sub>                    | 0.71       | W    |
| Pulsed Drain Current  | N-Ch         | t <sub>p</sub> = 10 μs | I <sub>DM</sub>                   | 18         | A    |
|   | P-Ch         |                        |                                   | -20        |      |
| Operating Junction and Storage Temperature                        |              |                        | T <sub>J</sub> , T <sub>STG</sub> | -55 to 150 | °C   |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) |              |                        | T <sub>L</sub>                    | 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.

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

## THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Max | Unit |
|-----------|--------|-----|------|
|-----------|--------|-----|------|

### SINGLE OPERATION (SELF-HEATED)

|   |                  |     |      |
|---|------------------|-----|------|
| Junction-to-Ambient – Steady State (Note 3)         | R <sub>θJA</sub> | 83  | °C/W |
| Junction-to-Ambient – Steady State Min Pad (Note 4) | R <sub>θJA</sub> | 177 |      |
| Junction-to-Ambient – t ≤ 5 s (Note 3)              | R <sub>θJA</sub> | 54  |      |

### DUAL OPERATION (EQUALLY HEATED)

|   |                  |     |      |
|---|------------------|-----|------|
| Junction-to-Ambient – Steady State (Note 3)         | R <sub>θJA</sub> | 58  | °C/W |
| Junction-to-Ambient – Steady State Min Pad (Note 4) | R <sub>θJA</sub> | 133 |      |
| Junction-to-Ambient – t ≤ 5 s (Note 3)              | R <sub>θJA</sub> | 40  |      |

- Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).
- Surface Mounted on FR4 Board using the minimum recommended pad size (30 mm<sup>2</sup>, 2 oz Cu).

# NTLJD3119C

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

| Parameter   | Symbol                               | N/P | Test Conditions                                 | Min                      | Typ  | Max  | Unit  |
|---|--------------------------------------|-----|---|--------------------------|------|------|-------|
| <b>OFF CHARACTERISTICS</b>                                |                                      |     |   |                          |      |      |       |
| Drain-to-Source Breakdown Voltage                         | V <sub>(BR)DSS</sub>                 | N   | V <sub>GS</sub> = 0 V                           | I <sub>D</sub> = 250 μA  | 20   |      | V     |
|   |                                      | P   |   | I <sub>D</sub> = -250 μA | -20  |      |       |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V <sub>(BR)DSS</sub> /T <sub>J</sub> | N   |   |                          | 10.4 |      | mV/°C |
|   |                                      | P   |   |                          | 9.95 |      |       |
| Zero Gate Voltage Drain Current                           | I <sub>DSS</sub>                     | N   | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 16 V   | T <sub>J</sub> = 25 °C   |      | 1.0  | μA    |
|   |                                      | P   | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = -16 V  |                          |      | -1.0 |       |
|   |                                      | N   | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 16 V   | T <sub>J</sub> = 85 °C   |      | 10   |       |
|   |                                      | P   | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = -16 V  |                          |      | -10  |       |
| Gate-to-Source Leakage Current                            | I <sub>GSS</sub>                     | N   | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±8.0 V |                          |      | ±100 | nA    |
|   |                                      | P   | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±8.0 V |                          |      | ±100 |       |

## ON CHARACTERISTICS (Note 5)

|  |                                     |   |   |                          |      |      |      |       |
|--|-------------------------------------|---|---|--------------------------|------|------|------|-------|
| Gate Threshold Voltage                 | V <sub>GS(TH)</sub>                 | N | V <sub>GS</sub> = V <sub>DS</sub>                 | I <sub>D</sub> = 250 μA  | 0.4  | 0.7  | 1.0  | V     |
|  |                                     | P |   | I <sub>D</sub> = -250 μA | -0.4 | -0.7 | -1.0 |       |
| Gate Threshold Temperature Coefficient | V <sub>GS(TH)</sub> /T <sub>J</sub> | N |   |                          |      | -3.0 |      | mV/°C |
|  |                                     | P |   |                          |      | 2.44 |      |       |
| Drain-to-Source On Resistance          | R <sub>DS(on)</sub>                 | N | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 3.8 A   |                          |      | 37   | 65   | mΩ    |
|  |                                     | P | V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -4.1 A |                          |      | 75   | 100  |       |
|  |                                     | N | V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 2.0 A   |                          |      | 46   | 85   |       |
|  |                                     | P | V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -2.0 A |                          |      | 101  | 135  |       |
|  |                                     | N | V <sub>GS</sub> = 1.8 V, I <sub>D</sub> = 1.7 A   |                          |      | 65   | 120  |       |
|  |                                     | P | V <sub>GS</sub> = -1.8 V, I <sub>D</sub> = -1.6 A |                          |      | 150  | 200  |       |
| Forward Transconductance               | g <sub>FS</sub>                     | N | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1.7 A    |                          |      | 4.2  |      | S     |
|  |                                     | P | V <sub>DS</sub> = -5.0 V, I <sub>D</sub> = -2.0 A |                          |      | 3.1  |      |       |

## CHARGES, CAPACITANCES AND GATE RESISTANCE

|                              |                     |   |  |  |  |     |     |    |  |    |
|------------------------------|---------------------|---|--|--|--|-----|-----|----|--|----|
| Input Capacitance            | C <sub>ISS</sub>    | N | f = 1.0 MHz, V <sub>GS</sub> = 0 V   | V <sub>DS</sub> = 10 V   |  | 271 |     | pF |  |    |
|                              |                     | P |  | V <sub>DS</sub> = -10 V  |  | 531 |     |    |  |    |
| Output Capacitance           | C <sub>OSS</sub>    | N |  | V <sub>DS</sub> = 10 V   |  | 72  |     |    |  |    |
|                              |                     | P |  | V <sub>DS</sub> = -10 V  |  | 91  |     |    |  |    |
| Reverse Transfer Capacitance | C <sub>RSS</sub>    | N |  | V <sub>DS</sub> = 10 V   |  | 43  |     |    |  |    |
|                              |                     | P |  | V <sub>DS</sub> = -10 V  |  | 56  |     |    |  |    |
| Total Gate Charge            | Q <sub>G(TOT)</sub> | N |  | V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 10 V, I <sub>D</sub> = 3.8 A    |  |     | 3.7 |    |  | nC |
|                              |                     | P |  | V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -10 V, I <sub>D</sub> = -2.0 A |  |     | 5.5 |    |  |    |
| Threshold Gate Charge        | Q <sub>G(TH)</sub>  | N |  | V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 10 V, I <sub>D</sub> = 3.8 A    |  |     | 0.3 |    |  |    |
|                              |                     | P |  | V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -10 V, I <sub>D</sub> = -2.0 A |  |     | 0.7 |    |  |    |
| Gate-to-Source Charge        | Q <sub>GS</sub>     | N | V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 10 V, I <sub>D</sub> = 3.8 A    |  |  | 0.6 |     |    |  |    |
|                              |                     | P | V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -10 V, I <sub>D</sub> = -2.0 A |  |  | 1.0 |     |    |  |    |
| Gate-to-Drain Charge         | Q <sub>GD</sub>     | N | V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 10 V, I <sub>D</sub> = 3.8 A    |  |  | 1.0 |     |    |  |    |
|                              |                     | P | V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -10 V, I <sub>D</sub> = -2.0 A |  |  | 1.4 |     |    |  |    |

# NTLJD3119C

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

| Parameter                                 | Symbol              | N/P | Test Conditions   | Min | Typ  | Max | Unit |
|---|---------------------|-----|---|-----|------|-----|------|
| <b>SWITCHING CHARACTERISTICS</b> (Note 6) |                     |     |   |     |      |     |      |
| Turn-On Delay Time                        | t <sub>d(ON)</sub>  | N   | V <sub>GS</sub> = 4.5 V, V <sub>DD</sub> = 16 V,<br>I <sub>D</sub> = 1.0 A, R <sub>G</sub> = 2.0 Ω    |     | 3.8  |     | ns   |
| Rise Time                                 | t <sub>r</sub>      |     |   |     | 4.7  |     |      |
| Turn-Off Delay Time                       | t <sub>d(OFF)</sub> |     |   |     | 11.1 |     |      |
| Fall Time                                 | t <sub>f</sub>      |     |   |     | 5.8  |     |      |
| Turn-On Delay Time                        | t <sub>d(ON)</sub>  | P   | V <sub>GS</sub> = -4.5 V, V <sub>DD</sub> = -10 V,<br>I <sub>D</sub> = -2.0 A, R <sub>G</sub> = 2.0 Ω |     | 5.2  |     |      |
| Rise Time                                 | t <sub>r</sub>      |     |   |     | 13.2 |     |      |
| Turn-Off Delay Time                       | t <sub>d(OFF)</sub> |     |   |     | 13.7 |     |      |
| Fall Time                                 | t <sub>f</sub>      |     |   |     | 19.1 |     |      |

## DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |                 |   |   |                         |  |       |      |    |
|-------------------------|-----------------|---|---|-------------------------|--|-------|------|----|
| Forward Diode Voltage   | V <sub>SD</sub> | N | V <sub>GS</sub> = 0 V, T <sub>J</sub> = 25 °C             | I <sub>S</sub> = 1.0 A  |  | 0.69  | 1.0  | V  |
|                         |                 | P |   | I <sub>S</sub> = -1.0 A |  | -0.75 | -1.0 |    |
|                         |                 | N | V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C            | I <sub>S</sub> = 1.0 A  |  | 0.52  |      |    |
|                         |                 | P |   | I <sub>S</sub> = -1.0 A |  | -0.64 |      |    |
| Reverse Recovery Time   | t <sub>RR</sub> | N | V <sub>GS</sub> = 0 V,<br>dI <sub>S</sub> / dt = 100 A/μs | I <sub>S</sub> = 1.0 A  |  | 10.2  |      | ns |
|                         |                 | P |   | I <sub>S</sub> = -1.0 A |  | 16.2  |      |    |
| Charge Time             | t <sub>a</sub>  | N |   | I <sub>S</sub> = 1.0 A  |  | 6.0   |      |    |
|                         |                 | P |   | I <sub>S</sub> = -1.0 A |  | 10.6  |      |    |
| Discharge Time          | t <sub>b</sub>  | N |   | I <sub>S</sub> = 1.0 A  |  | 4.2   |      | nC |
|                         |                 | P |   | I <sub>S</sub> = -1.0 A |  | 5.6   |      |    |
| Reverse Recovery Charge | Q <sub>RR</sub> | N |   | I <sub>S</sub> = 1.0 A  |  | 3.0   |      | nC |
|                         |                 | P |   | I <sub>S</sub> = -1.0 A |  | 5.7   |      |    |

5. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

6. Switching characteristics are independent of operating junction temperatures.

# NTLJD3119C

## TYPICAL PERFORMANCE CURVES – N-CHANNEL ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

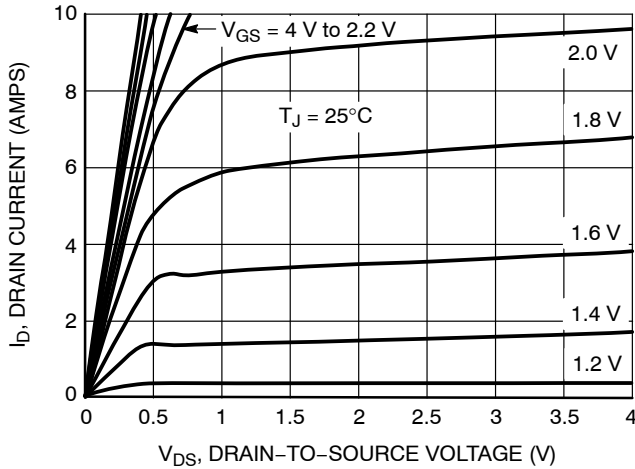


Figure 1. On-Region Characteristics

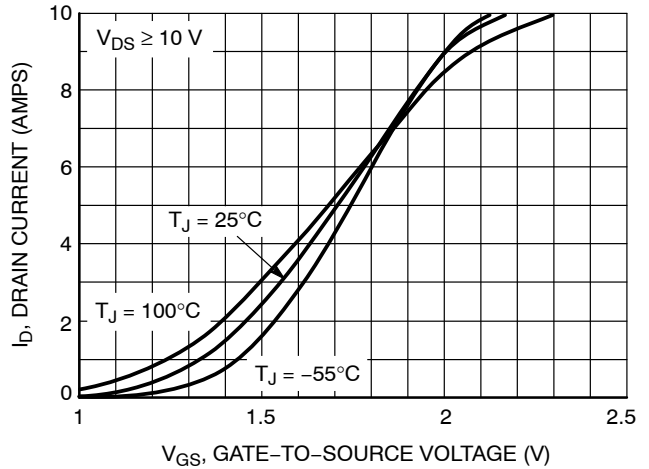


Figure 2. Transfer Characteristics

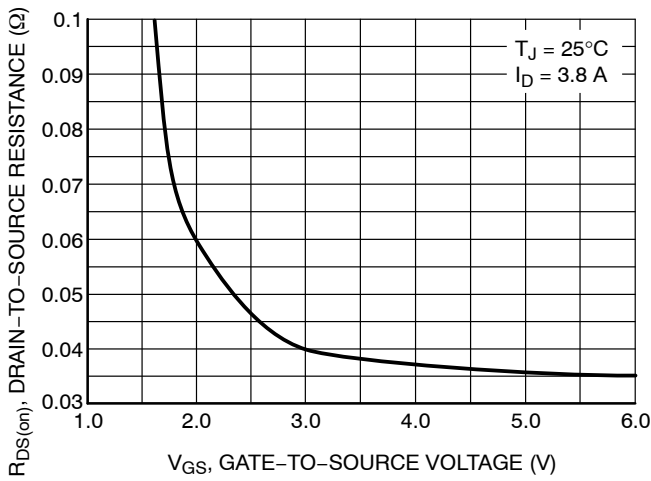


Figure 3. On-Resistance versus Drain Current

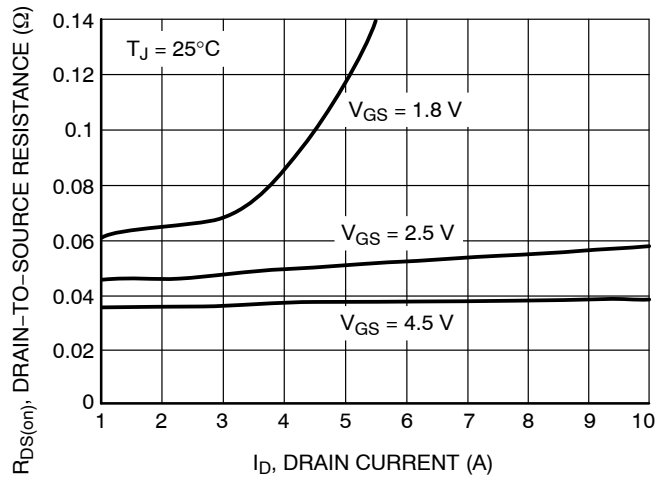


Figure 4. On-Resistance versus Drain Current and Gate Voltage

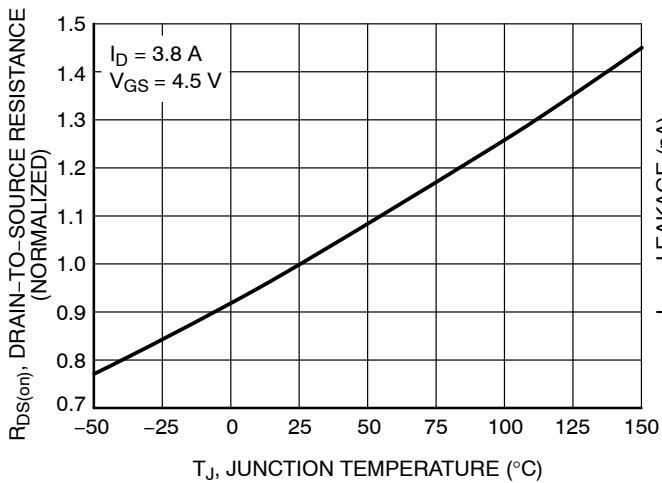


Figure 5. On-Resistance Variation with Temperature

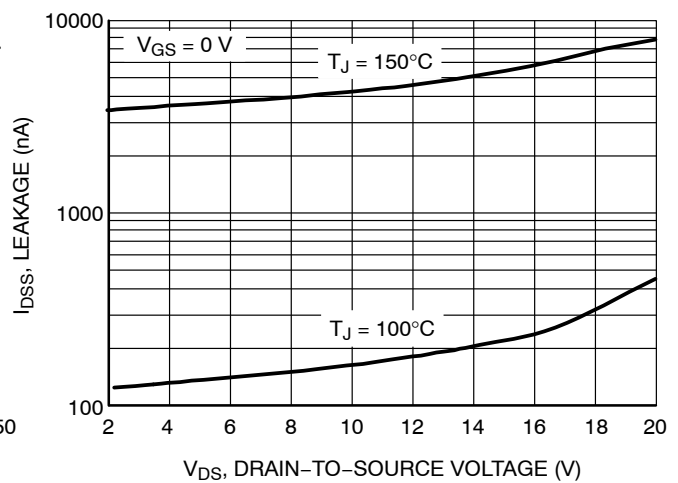


Figure 6. Drain-to-Source Leakage Current versus Voltage

TYPICAL PERFORMANCE CURVES – N-CHANNEL ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

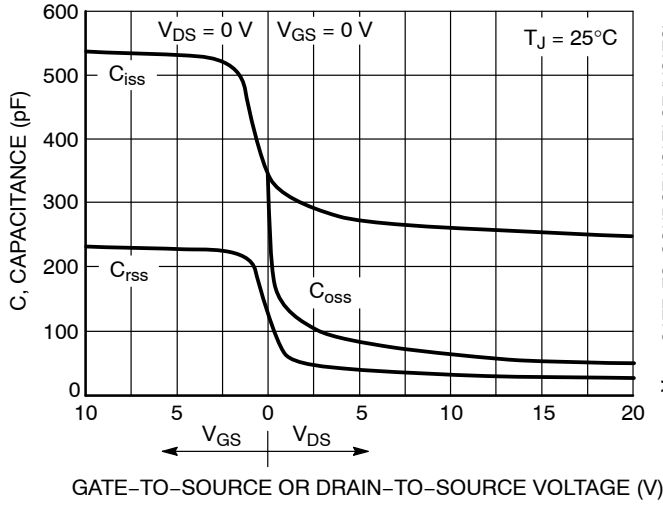


Figure 7. Capacitance Variation

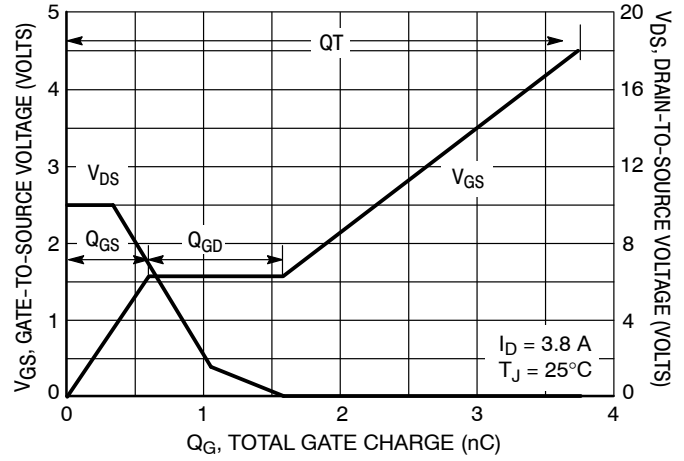


Figure 8. Gate-To-Source and Drain-To-Source Voltage versus Total Charge

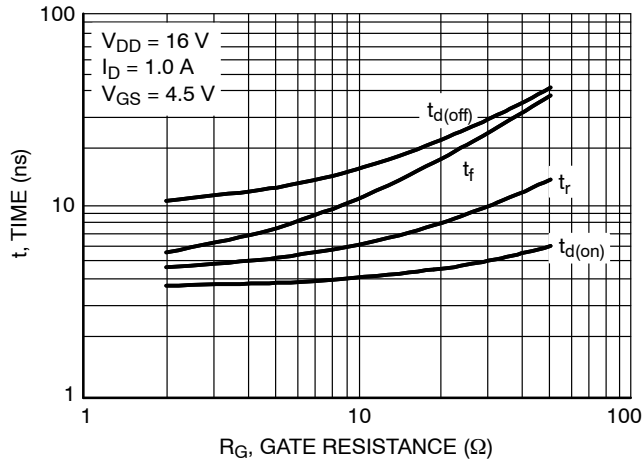


Figure 9. Resistive Switching Time Variation versus Gate Resistance

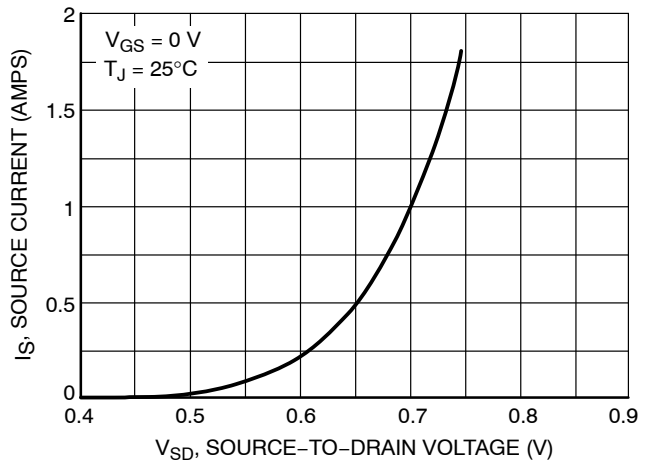
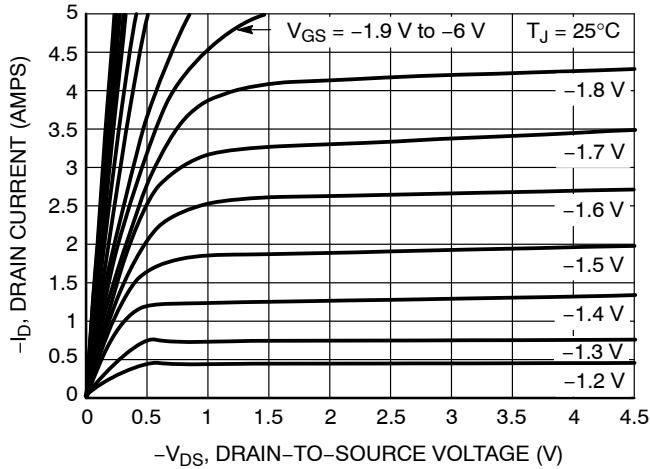


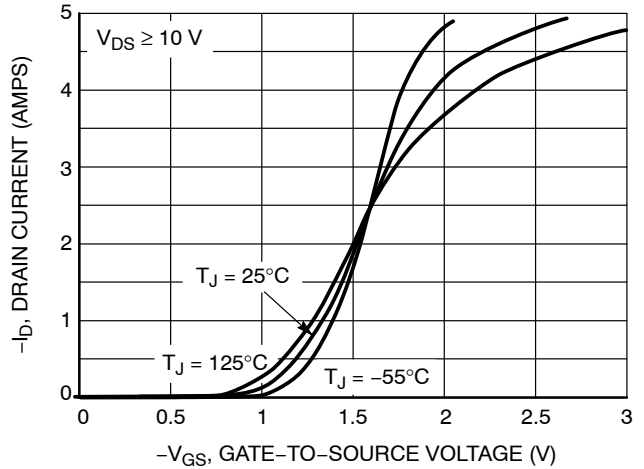
Figure 10. Diode Forward Voltage versus Current

# NTLJD3119C

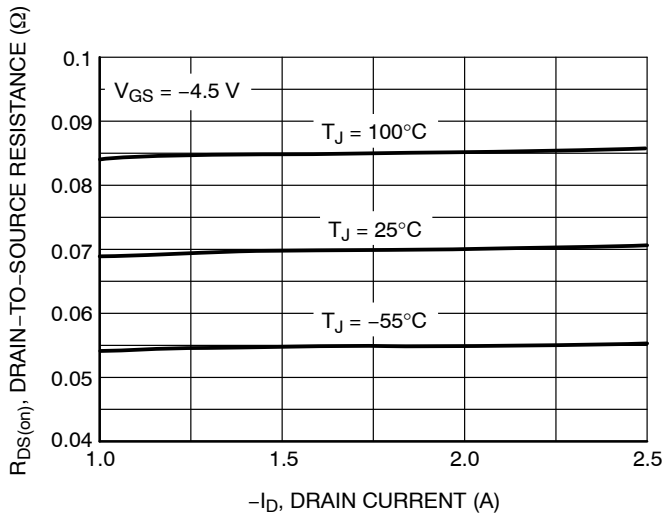
## TYPICAL PERFORMANCE CURVES – P-CHANNEL ( $T_J = 25^\circ\text{C}$ unless otherwise noted)



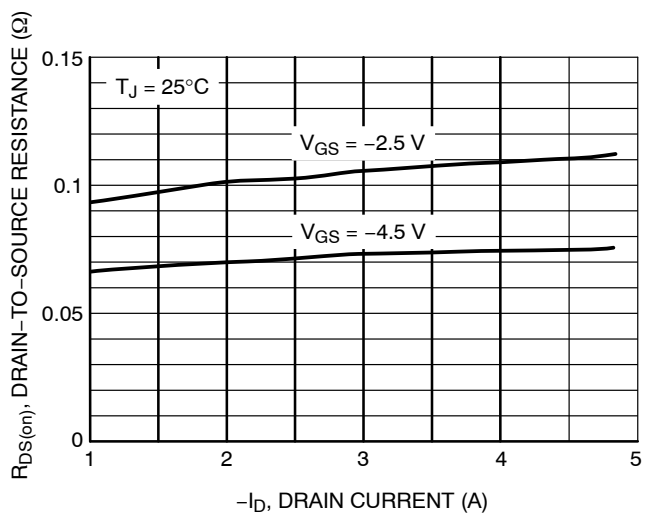
**Figure 11. On-Region Characteristics**



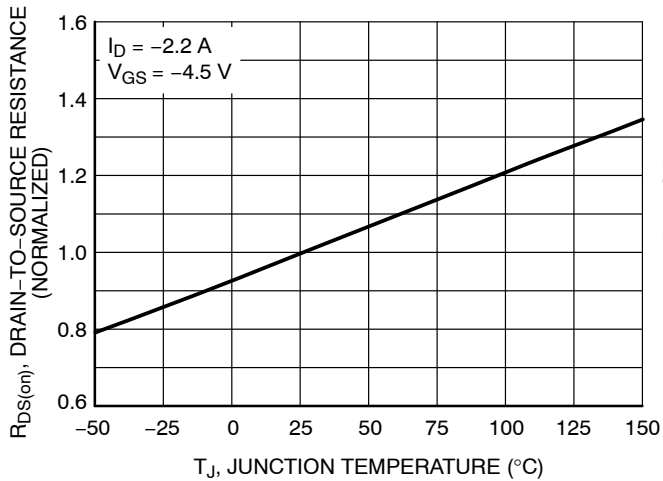
**Figure 12. Transfer Characteristics**



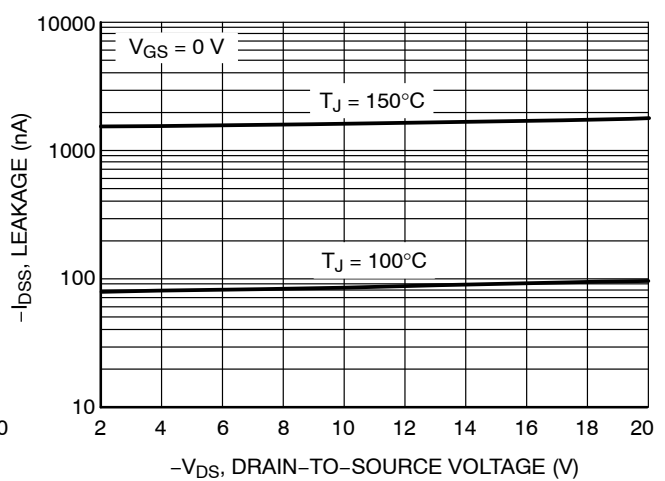
**Figure 13. On-Resistance versus Drain Current**



**Figure 14. On-Resistance versus Drain Current and Gate Voltage**



**Figure 15. On-Resistance Variation with Temperature**



**Figure 16. Drain-to-Source Leakage Current versus Voltage**

TYPICAL PERFORMANCE CURVES – P-CHANNEL ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

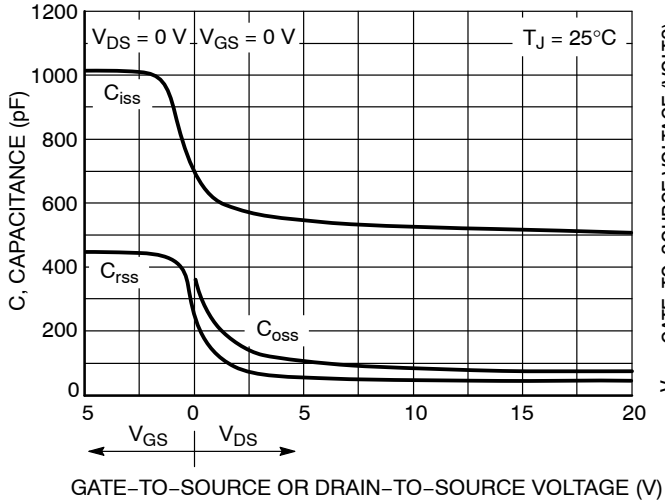


Figure 17. Capacitance Variation

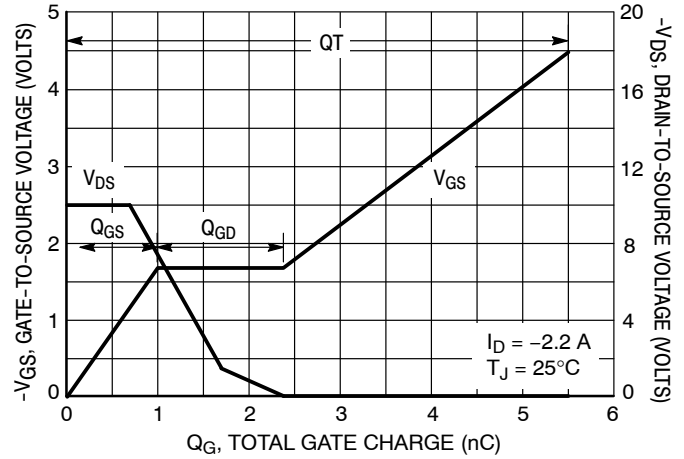


Figure 18. Gate-To-Source and Drain-To-Source Voltage versus Total Charge

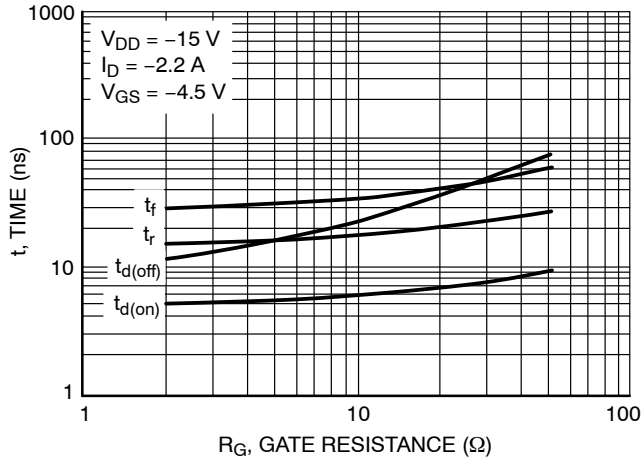


Figure 19. Resistive Switching Time Variation versus Gate Resistance

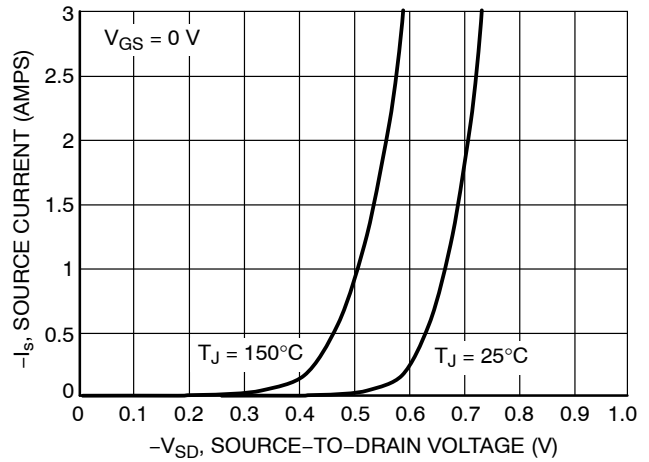


Figure 20. Diode Forward Voltage versus Current

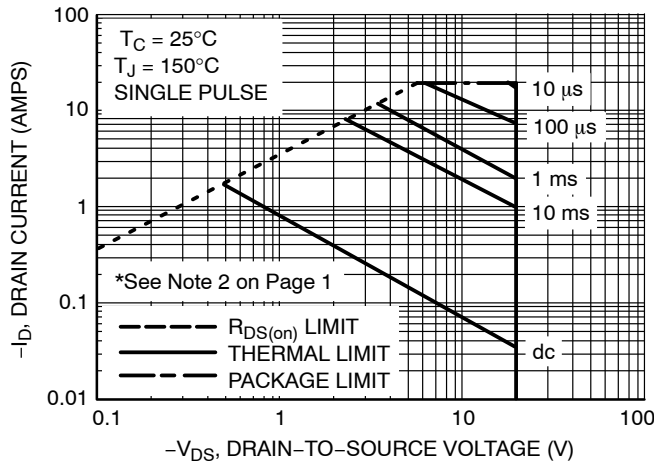


Figure 21. Maximum Rated Forward Biased Safe Operating Area



# NTLJD3119C

## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

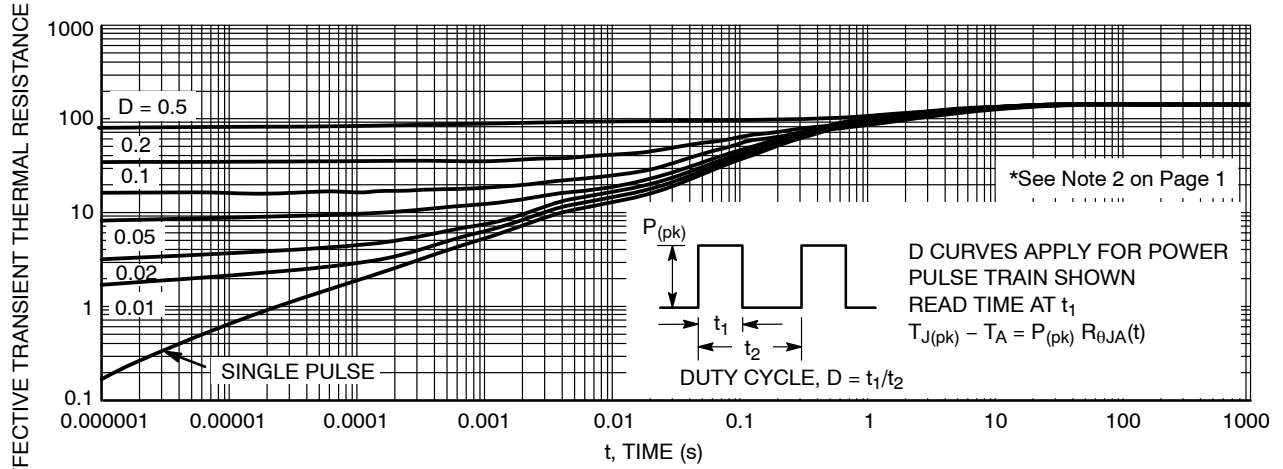
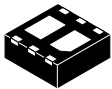
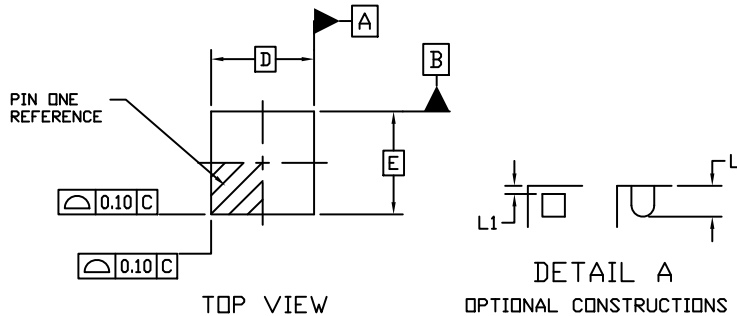


Figure 22. Thermal Response



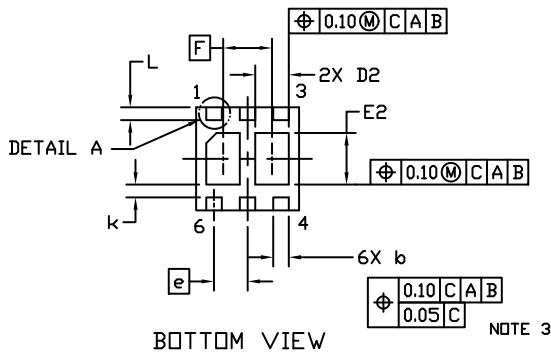
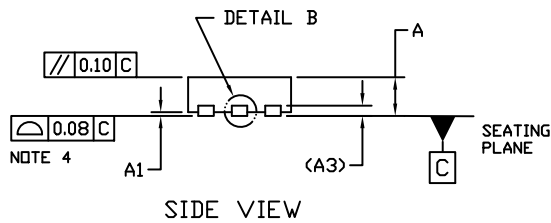
WDFN6 2x2, 0.65P  
CASE 506AN  
ISSUE H

DATE 25 JAN 2022



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.



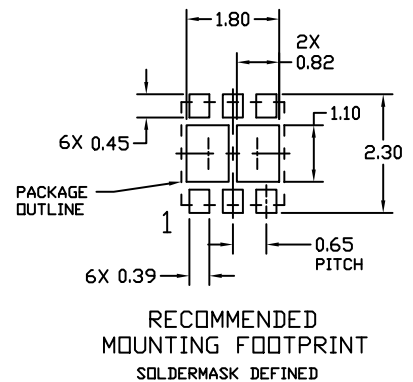
| DIM      | MILLIMETERS |      |
|----------|-------------|------|
|          | MIN.        | MAX. |
| A        | 0.70        | 0.80 |
| A1       | 0.00        | 0.05 |
| A3       | 0.20 REF    |      |
| <i>b</i> | 0.25        | 0.35 |
| D        | 2.00 BSC    |      |
| D2       | 0.57        | 0.77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

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.



|                  |                  |  |
|------------------|------------------|--|
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