

NTLJD3119C

Power MOSFET

20 V/-20 V, 4.6 A/-4.1 A, μ Cool™
Complementary, 2x2 mm, WDFN Package

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

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

| Parameter | | Symbol | Value | Unit |
|--|-----------------|-----------------------------------|-----------------------|------|
| Drain-to-Source Voltage | N-Ch | V _{DSS} | 20 | V |
| | P-Ch | | -20 | |
| Gate-to-Source Voltage | N-Ch | V _{GS} | ±8.0 | V |
| | P-Ch | | | |
| N-Channel Continuous Drain Current (Note 1) | Steady State | T _A = 25°C | I _D | 3.8 |
| | | T _A = 85°C | | 2.8 |
| | | t ≤ 5 s | T _A = 25°C | |
| P-Channel Continuous Drain Current (Note 1) | Steady State | T _A = 25°C | I _D | -3.3 |
| | | T _A = 85°C | | -2.4 |
| | | t ≤ 5 s | T _A = 25°C | |
| Power Dissipation (Note 1) | Steady State | T _A = 25°C | P _D | 1.5 |
| | | | | 2.3 |
| N-Channel Continuous Drain Current (Note 2) | Steady State | T _A = 25°C | I _D | 2.6 |
| | | T _A = 85°C | | 1.9 |
| P-Channel Continuous Drain Current (Note 2) | Steady State | T _A = 25°C | I _D | -2.3 |
| | | T _A = 85°C | | -1.6 |
| Power Dissipation (Note 2) | Steady State | T _A = 25°C | P _D | 0.71 |
| Pulsed Drain Current | N-Ch | t _p = 10 μs | I _{DM} | 18 |
| | P-Ch | | | -20 |
| Operating Junction and Storage Temperature | | T _J , T _{STG} | -55 to 150 | °C |
| 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.

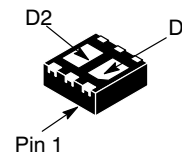
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).
2. Surface Mounted on FR4 Board using the minimum recommended pad size of 30 mm², 2 oz Cu.



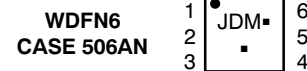
ON Semiconductor®

<http://onsemi.com>

| V _{(BR)DSS} | R _{DS(on)} MAX | I _D MAX |
|----------------------|-------------------------|--------------------|
| N-Channel 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 -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 |

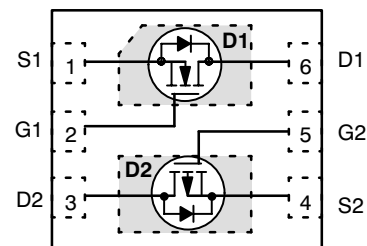


MARKING DIAGRAM



JD = 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† |
|---------------|-----------------|------------------|
| NTLJD3119CTAG | WDFN6 (Pb-Free) | 3000/Tape & Reel |
| NTLJD3119CTBG | WDFN6 (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.

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THERMAL RESISTANCE RATINGS

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

SINGLE OPERATION (SELF-HEATED)

| | | | |
|---|-----------------|-----|------|
| Junction-to-Ambient – Steady State (Note 3) | $R_{\theta JA}$ | 83 | °C/W |
| Junction-to-Ambient – Steady State Min Pad (Note 4) | $R_{\theta JA}$ | 177 | |
| Junction-to-Ambient – $t \leq 5$ s (Note 3) | $R_{\theta JA}$ | 54 | |

DUAL OPERATION (EQUALLY HEATED)

| | | | |
|---|-----------------|-----|------|
| Junction-to-Ambient – Steady State (Note 3) | $R_{\theta JA}$ | 58 | °C/W |
| Junction-to-Ambient – Steady State Min Pad (Note 4) | $R_{\theta JA}$ | 133 | |
| Junction-to-Ambient – $t \leq 5$ s (Note 3) | $R_{\theta JA}$ | 40 | |

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 (30 mm², 2 oz Cu).

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

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

ON CHARACTERISTICS (Note 5)

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

CHARGES, CAPACITANCES AND GATE RESISTANCE

| | | | | | | | | |
|------------------------------|---------------------|---|--|--|-----|-----|----|----|
| Input Capacitance | C _{ISS} | N | f = 1.0 MHz, V _{GS} = 0 V | V _{DS} = 10 V | | 271 | pF | |
| | | P | | V _{DS} = -10 V | | 531 | | |
| Output Capacitance | C _{OSS} | N | | V _{DS} = 10 V | | 72 | | |
| | | P | | V _{DS} = -10 V | | 91 | | |
| Reverse Transfer Capacitance | C _{RSS} | N | | V _{DS} = 10 V | | 43 | | |
| | | P | | V _{DS} = -10 V | | 56 | | |
| Total Gate Charge | Q _{G(TOT)} | N | | V _{GS} = 4.5 V, V _{DS} = 10 V, I _D = 3.8 A | | 3.7 | | nC |
| | | P | | V _{GS} = -4.5 V, V _{DS} = -10 V, I _D = -2.0 A | | 5.5 | | |
| Threshold Gate Charge | Q _{G(TH)} | N | | V _{GS} = 4.5 V, V _{DS} = 10 V, I _D = 3.8 A | | 0.3 | | |
| | | P | | V _{GS} = -4.5 V, V _{DS} = -10 V, I _D = -2.0 A | | 0.7 | | |
| Gate-to-Source Charge | Q _{GS} | N | V _{GS} = 4.5 V, V _{DS} = 10 V, I _D = 3.8 A | | 0.6 | | | |
| | | P | V _{GS} = -4.5 V, V _{DS} = -10 V, I _D = -2.0 A | | 1.0 | | | |
| Gate-to-Drain Charge | Q _{GD} | N | V _{GS} = 4.5 V, V _{DS} = 10 V, I _D = 3.8 A | | 1.0 | | | |
| | | P | V _{GS} = -4.5 V, V _{DS} = -10 V, I _D = -0.2 A | | 1.4 | | | |

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

| Parameter | Symbol | N/P | Test Conditions | Min | Typ | Max | Unit |
|---|---------------------|-----|---|-----|------|-----|------|
| SWITCHING CHARACTERISTICS (Note 6) | | | | | | | |
| Turn-On Delay Time | t _{d(ON)} | N | V _{GS} = 4.5 V, V _{DD} = 16 V, I _D = 1.0 A, R _G = 2.0 Ω | | 3.8 | | ns |
| Rise Time | t _r | | | | 4.7 | | |
| Turn-Off Delay Time | t _{d(OFF)} | | | | 11.1 | | |
| Fall Time | t _f | | | | 5.8 | | |
| Turn-On Delay Time | t _{d(ON)} | P | V _{GS} = -4.5 V, V _{DD} = -10 V, I _D = -2.0 A, R _G = 2.0 Ω | | 5.2 | | |
| Rise Time | t _r | | | | 13.2 | | |
| Turn-Off Delay Time | t _{d(OFF)} | | | | 13.7 | | |
| Fall Time | t _f | | | | 19.1 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-------------------------|-----------------|---|---|-------------------------|-------|------|----|
| Forward Diode Voltage | V _{SD} | N | V _{GS} = 0 V, T _J = 25 °C | I _S = 1.0 A | 0.69 | 1.0 | V |
| | | P | | I _S = -1.0 A | -0.75 | -1.0 | |
| | | N | V _{GS} = 0 V, T _J = 125 °C | I _S = 1.0 A | 0.52 | | |
| | | P | | I _S = -1.0 A | -0.64 | | |
| Reverse Recovery Time | t _{RR} | N | V _{GS} = 0 V, dI _S / dt = 100 A/μs | I _S = 1.0 A | 10.2 | | ns |
| | | P | | I _S = -1.0 A | 16.2 | | |
| Charge Time | t _a | N | | I _S = 1.0 A | 6.0 | | |
| | | P | | I _S = -1.0 A | 10.6 | | |
| Discharge Time | t _b | N | | I _S = 1.0 A | 4.2 | | |
| | | P | | I _S = -1.0 A | 5.6 | | |
| Reverse Recovery Charge | Q _{RR} | N | | I _S = 1.0 A | 3.0 | | nC |
| | | P | | I _S = -1.0 A | 5.7 | | |

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

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

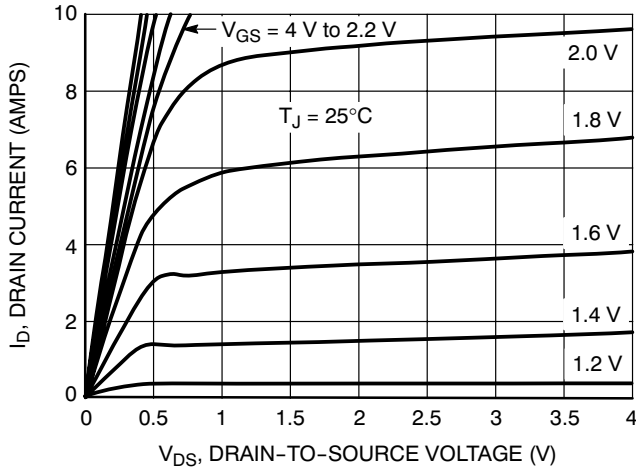


Figure 1. On-Region Characteristics

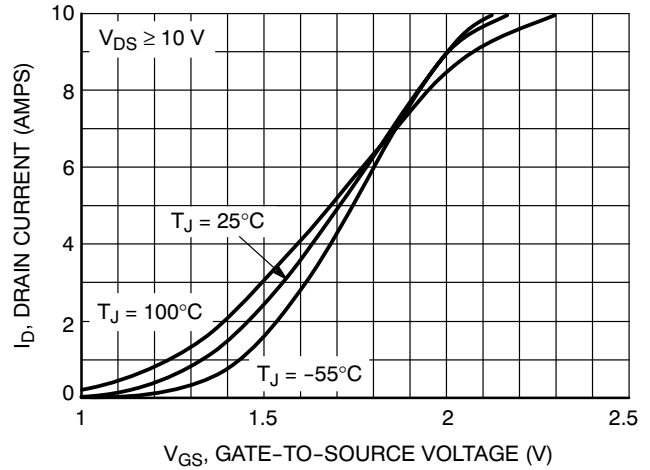


Figure 2. Transfer Characteristics

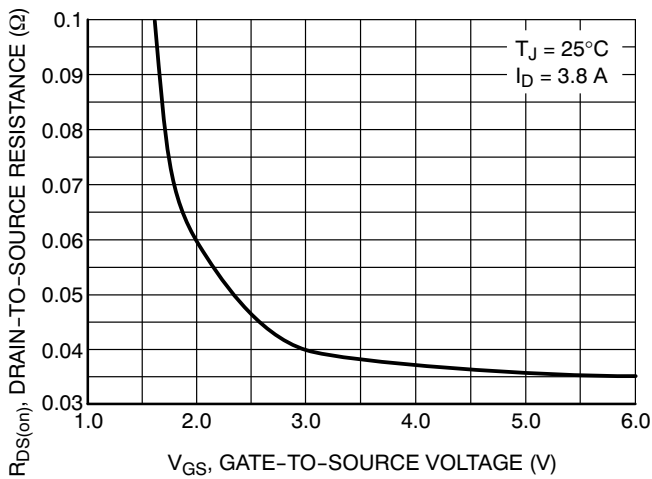


Figure 3. On-Resistance versus Drain Current

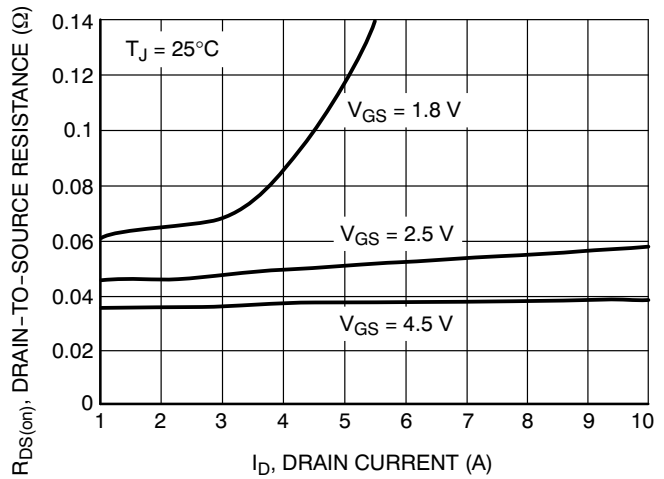


Figure 4. On-Resistance versus Drain Current and Gate Voltage

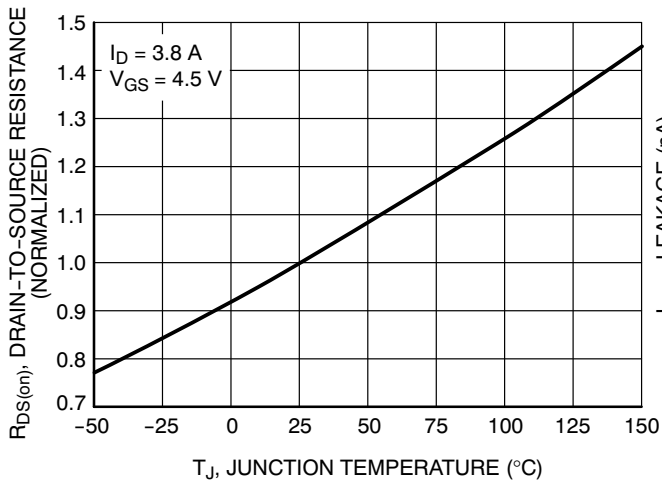


Figure 5. On-Resistance Variation with Temperature

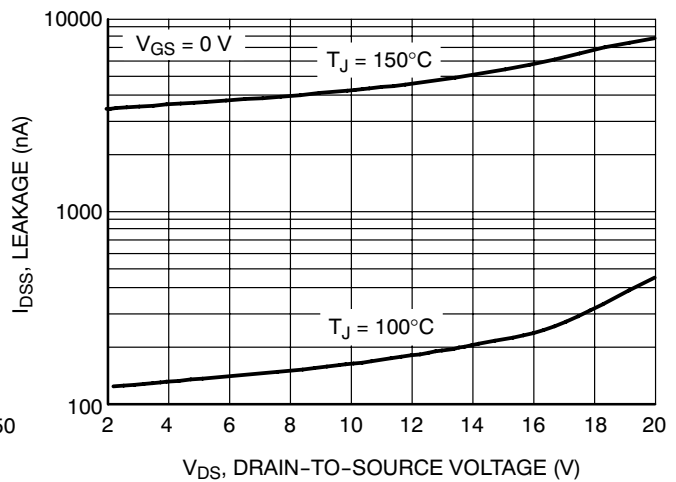


Figure 6. Drain-to-Source Leakage Current versus Voltage

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

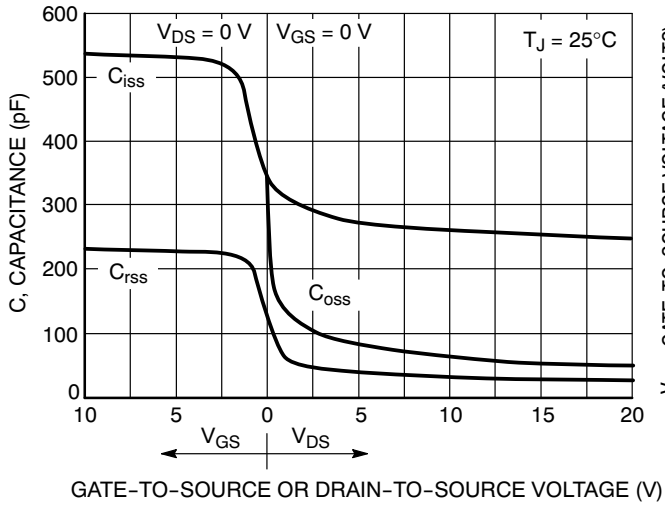


Figure 7. Capacitance Variation

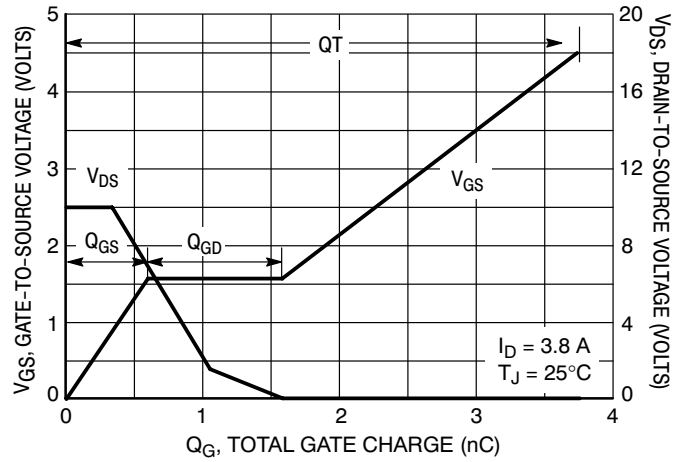


Figure 8. Gate-To-Source and Drain-To-Source Voltage versus Total Charge

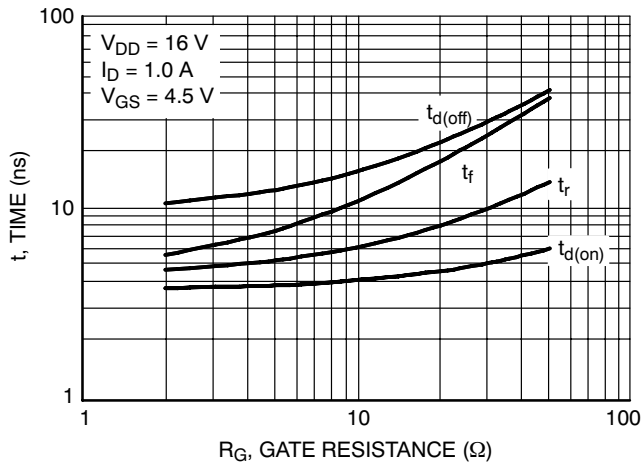


Figure 9. Resistive Switching Time Variation versus Gate Resistance

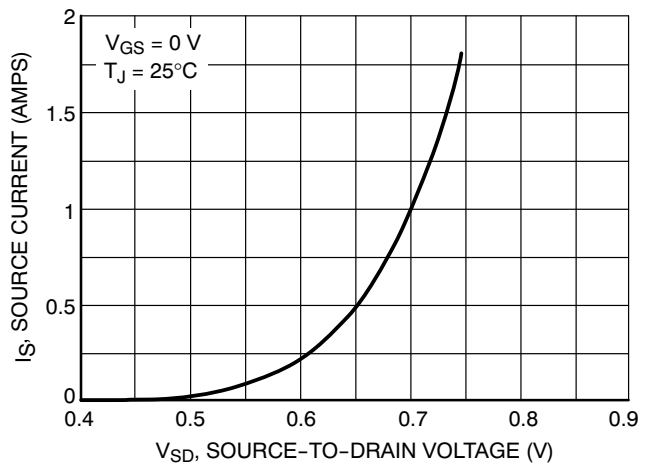


Figure 10. Diode Forward Voltage versus Current

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

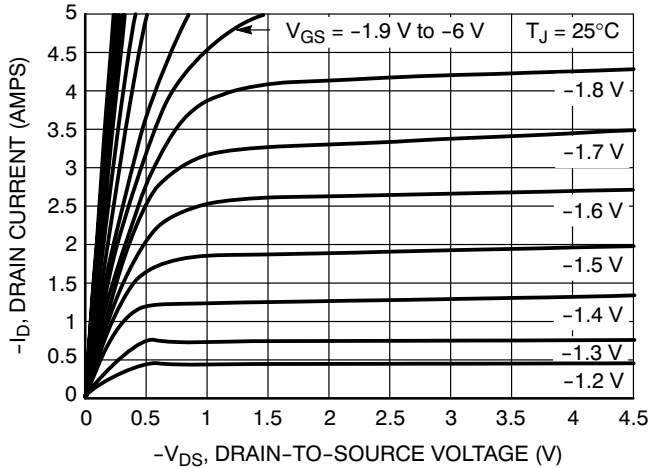


Figure 11. On-Region Characteristics

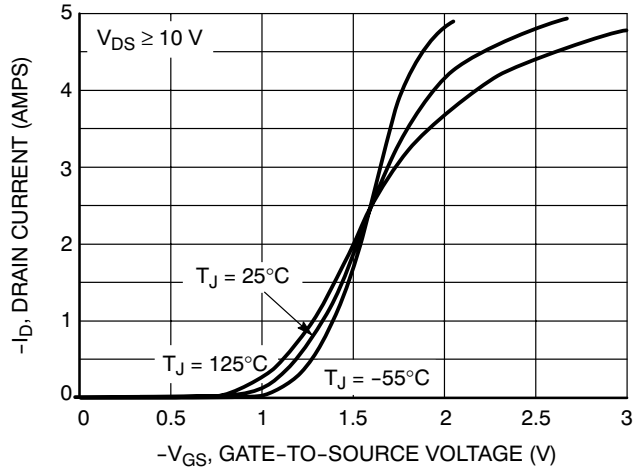


Figure 12. Transfer Characteristics

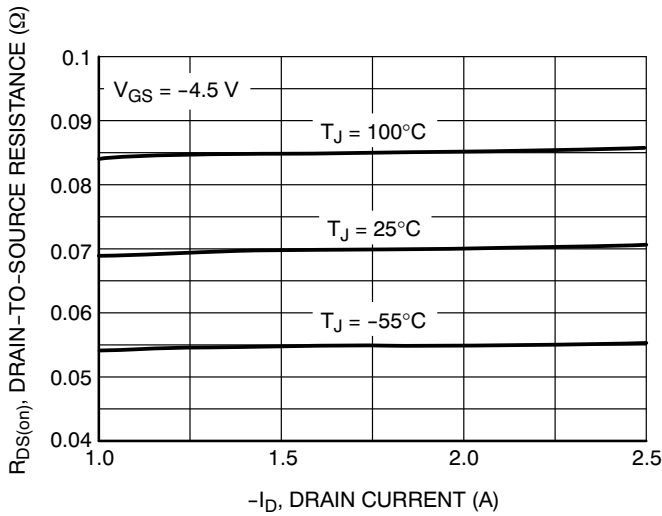


Figure 13. On-Resistance versus Drain Current

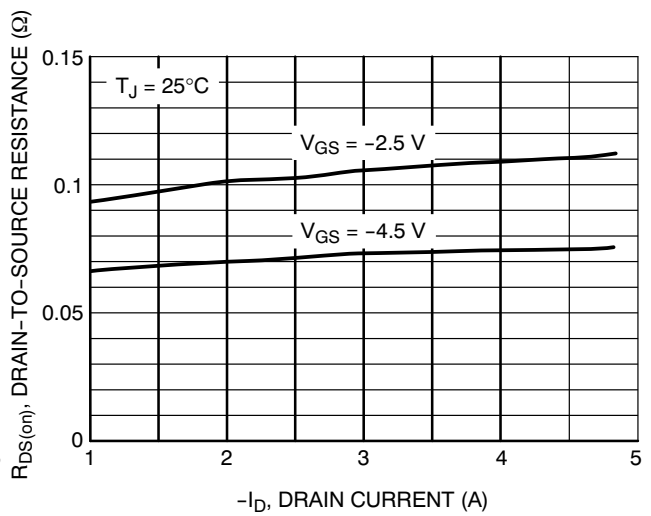


Figure 14. On-Resistance versus Drain Current and Gate Voltage

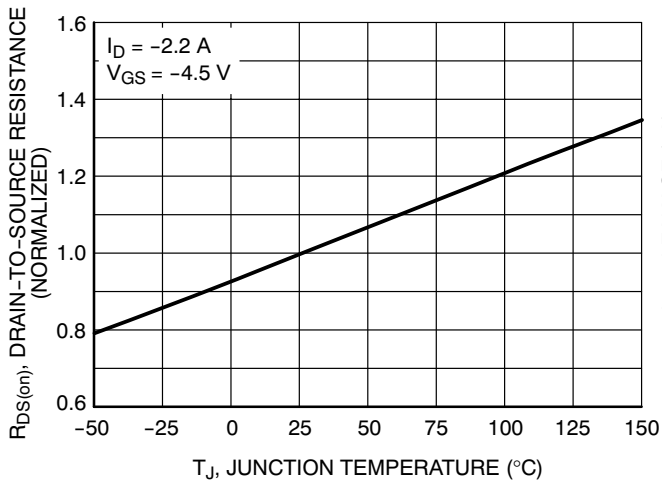


Figure 15. On-Resistance Variation with Temperature

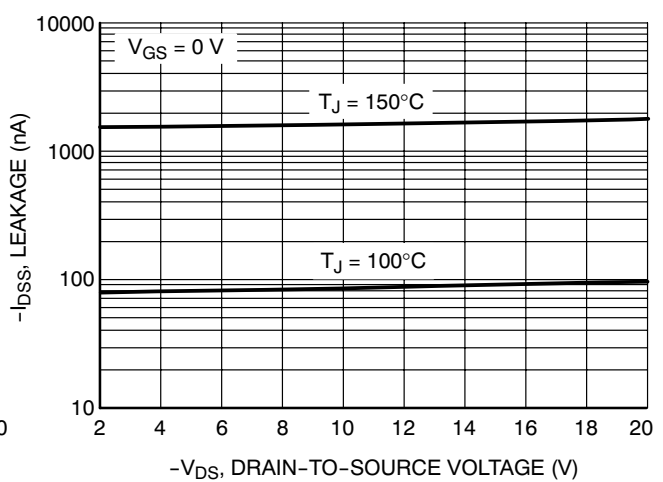


Figure 16. Drain-to-Source Leakage Current versus Voltage

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

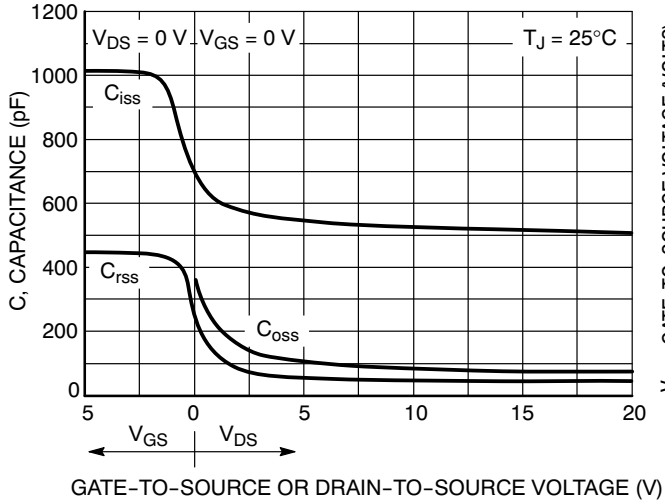


Figure 17. Capacitance Variation

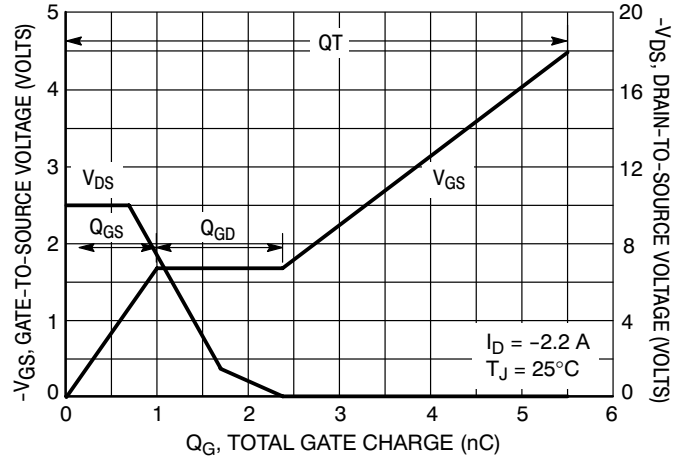


Figure 18. Gate-To-Source and Drain-To-Source Voltage versus Total Charge

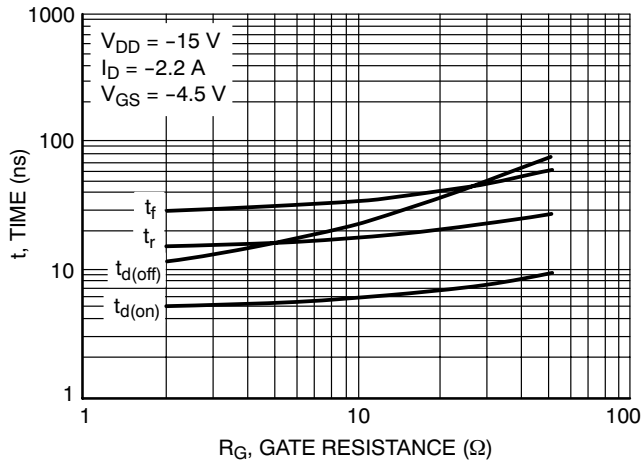


Figure 19. Resistive Switching Time Variation versus Gate Resistance

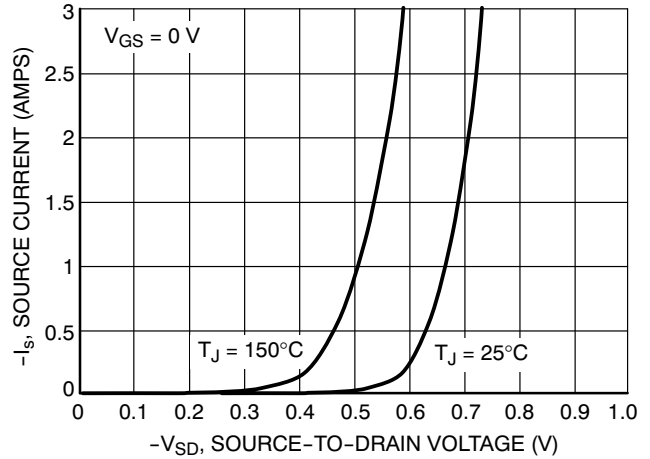


Figure 20. Diode Forward Voltage versus Current

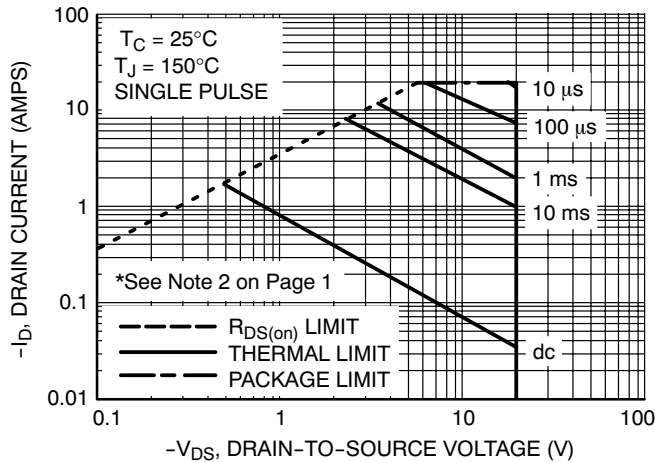


Figure 21. Maximum Rated Forward Biased Safe Operating Area

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

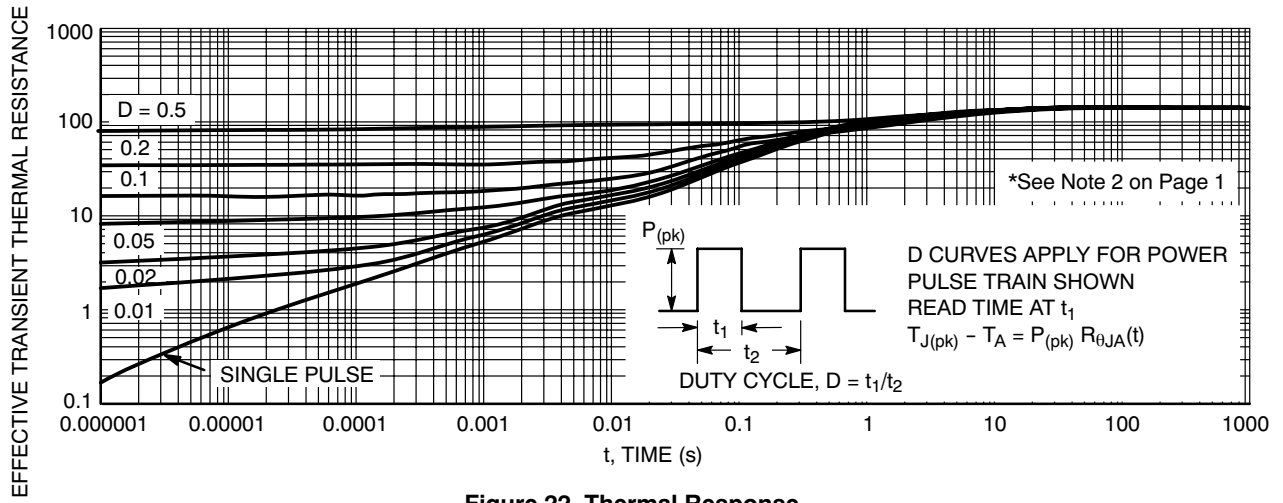
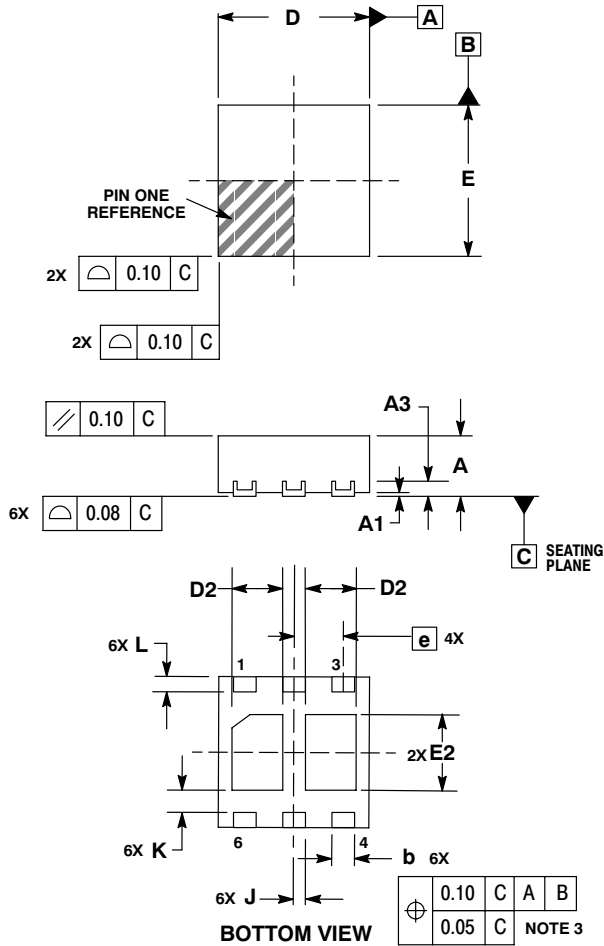


Figure 22. Thermal Response

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PACKAGE DIMENSIONS

WDFN6, 2x2
CASE 506AN-01
ISSUE B

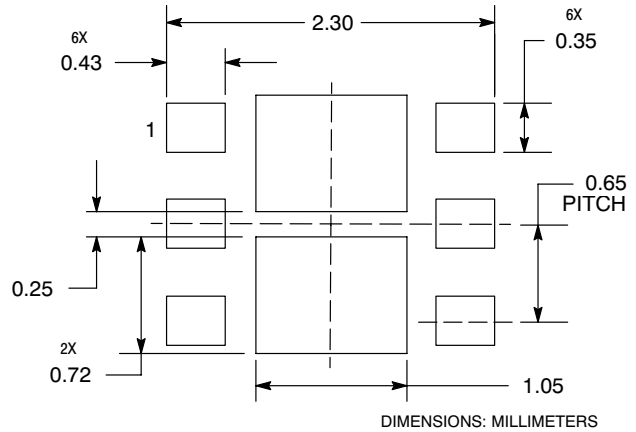


NOTES:

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 0.20mm FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

| 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 | |
| K | 0.25 REF | |
| L | 0.20 | 0.30 |
| J | 0.15 REF | |

SOLDERMASK DEFINED MOUNTING FOOTPRINT*



*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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