Power MOSFET

30 V, 7.8 A, µCool™ Single N–Channel, 2x2 mm WDFN Package

Features

- WDFN Package Provides Exposed Drain Pad for Excellent Thermal Conduction
- 2x2 mm Footprint Same as SC-88
- Lowest R_{DS(on)} in 2x2 mm Package
- 1.8 V R_{DS(on)} Rating for Operation at Low Voltage Logic Level Gate Drive
- Low Profile (< 0.8 mm) for Easy Fit in Thin Environments
- This is a Pb-Free Device

Applications

- DC-DC Conversion
- Boost Circuits for LED Backlights
- Optimized for Battery and Load Management Applications in Portable Equipment such as, Cell Phones, PDA's, Media Players, etc.
- Low Side Load Switch

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 | ge | | V_{GS} | ±8.0 | V |
| Continuous Drain | Steady | $T_A = 25^{\circ}C$ | I _D | 6.0 | Α |
| Current (Note 1) | State T _A = 85°C | | | 4.4 | |
| | t ≤ 5 s | T _A = 25°C | | 7.8 | |
| Power Dissipation (Note 1) | Steady State | T _A = 25°C | P _D | 1.92 | W |
| | t ≤ 5 s | | | 3.3 | |
| Continuous Drain | | $T_A = 25^{\circ}C$ | I _D | 3.6 | Α |
| Current (Note 2) | Steady | T _A = 85°C | | 2.6 | |
| Power Dissipation (Note 2) | State T _A = 25°C | | P_{D} | 0.70 | W |
| Pulsed Drain Current | t _p = 10 μs | | I _{DM} | 28 | Α |
| Operating Junction and Storage Temperature | | | T_J , T_{STG} | –55 to 150 | °C |
| Source Current (Body Diode) (Note 2) | | | I _S | 3.0 | Α |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | | | TL | 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.

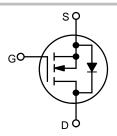
- Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).
- Surface Mounted on FR4 Board using the minimum recommended pad size of 30 mm2, 2 oz Cu.



ON Semiconductor®

http://onsemi.com

| V _{(BR)DSS} | R _{DS(on)} MAX | I _D MAX (Note 1) |
|----------------------|-------------------------|-----------------------------|
| | 35 m Ω @ 4.5 V | |
| 30 V | 45 mΩ @ 2.5 V | 7.8 A |
| | 55 mΩ @ 1.8 V | |



N-CHANNEL MOSFET





1 2 3 JBM• 6 5 4

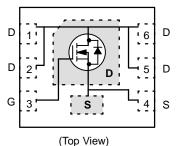
JB = Specific Device Code

M = Date Code

= Pb-Free Package

(Note: Microdot may be in either location)

PIN CONNECTIONS



, , ,

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|---------------|--------------------|-----------------------|
| NTLJS4159NT1G | 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.

THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Max | Unit |
|---|----------------|-----|------|
| Junction-to-Ambient - Steady State (Note 3) | $R_{	heta JA}$ | 65 | |
| Junction-to-Ambient - t ≤ 5 s (Note 3) | $R_{	heta JA}$ | 38 | °C/W |
| Junction-to-Ambient - Steady State Min Pad (Note 4) | $R_{	heta JA}$ | 180 | |

- 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 mm², 2 oz Cu).

$\textbf{MOSFET ELECTRICAL CHARACTERISTICS} \ (T_J = 25^{\circ}\text{C unless otherwise noted})$

| Parameter | Symbol | Test Conditions | | Min | Тур | Max | Unit |
|--|--|---|------------------------|-----|-------|------|-------|
| OFF CHARACTERISTICS | <u>. </u> | | | | _ | | - |
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$ | | 30 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V _{(BR)DSS} /T _J | $I_D = 250 \mu A$, Ref to $25^{\circ}C$ | | | 20 | | mV/°C |
| Zero Gate Voltage Drain Current | I _{DSS} | | $T_J = 25^{\circ}C$ | | | 1.0 | μΑ |
| | | $V_{DS} = 24 \text{ V}, V_{GS} = 0 \text{ V}$ | $T_J = 65^{\circ}C$ | | | 1.0 | 1 |
| | | | T _J = 85°C | | | 5.0 | 1 |
| Gate-to-Source Leakage Current | I _{GSS} | $V_{DS} = 0 \text{ V}, V_{GS} = \pm$ | 8.0 V | | | ±100 | nA |
| ON CHARACTERISTICS (Note 5) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}$, $I_D = 25$ | 50 μΑ | 0.4 | 0.7 | 1.0 | V |
| Negative Gate Threshold Temperature Coefficient | V _{GS(TH)} /T _J | | | | 3.18 | | mV/°C |
| Drain-to-Source On-Resistance | R _{DS(on)} | $V_{GS} = 4.5, I_D = 2$ | .0 A | | 20.3 | 35 | mΩ |
| | . , | $V_{GS} = 2.5, I_D = 2$ | .0 A | | 25.8 | 45 | 1 |
| | | $V_{GS} = 1.8, I_D = 1$ | .8 A | | 35.2 | 55 | 1 |
| Forward Transconductance | 9FS | V _{DS} = 16 V, I _D = 2 | 2.0 A | | 5.3 | | S |
| CHARGES, CAPACITANCES AND GA | ATE RESISTAN | CE | | | | | |
| Input Capacitance | C _{ISS} | | | | 1045 | | pF |
| Output Capacitance | C _{OSS} | $V_{GS} = 0 \text{ V, f} = 1.0 \text{ V}$ $V_{DS} = 15 \text{ V}$ | MHz, | | 115.5 | | 1 |
| Reverse Transfer Capacitance | C _{RSS} | VDS = 13 V | | | 45.3 | | 1 |
| Total Gate Charge | Q _{G(TOT)} | $V_{GS} = 4.5 \text{ V}, V_{DS} = 15 \text{ V},$ $I_D = 2.0 \text{ A}$ | | | 12.1 | 13 | nC |
| Threshold Gate Charge | Q _{G(TH)} | | | | 1.2 | | 1 |
| Gate-to-Source Charge | Q _{GS} | | | | 1.9 | | |
| Gate-to-Drain Charge | Q_GD | | | | 2.7 | | |
| Gate Resistance | R_{G} | | | | 3.65 | | Ω |
| SWITCHING CHARACTERISTICS (No | ote 6) | | | | | | • |
| Turn-On Delay Time | t _{d(ON)} | | | | 6.8 | | ns |
| Rise Time | t _r | $V_{GS} = 4.5 \text{ V}, V_{DD} =$ | 15 V. | | 12.4 | | 1 |
| Turn-Off Delay Time | t _{d(OFF)} | $I_D = 2.0 \text{ A}, R_G = 3.0 \Omega$ | | | 26 | | |
| Fall Time | t _f | | | | 5.1 | | 1 |
| DRAIN-SOURCE DIODE CHARACTE | RISTICS | | | | • | • | • |
| Forward Recovery Voltage | V_{SD} | | T _J = 25°C | | 0.71 | 1.2 | Ι ,, |
| - | | $V_{GS} = 0 \text{ V, IS} = 2.0 \text{ A}$ | T _J = 125°C | | 0.58 | | - V |
| Reverse Recovery Time | t _{RR} | $V_{GS} = 0 \text{ V, } d_{ISD}/d_t = 100 \text{ A/}\mu\text{s,}$ $I_S = 1.0 \text{ A}$ | | | 15 | 35 | 1 |
| Charge Time | ta | | | | 9.0 | | ns |
| Discharge Time | t _b | | | | 6.0 | | 1 |
| Reverse Recovery Time | Q_{RR} | | | | 7.0 | | nC |

- 5. Pulse Test: Pulse Width \leq 300 $\mu s,$ Duty Cycle \leq 2%.
- 6. Switching characteristics are independent of operating junction temperatures.

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

 $V_{DS} \ge 10 \text{ V}$

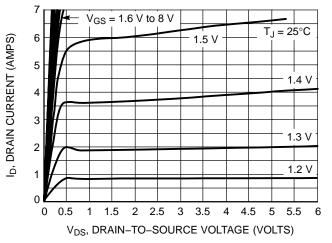
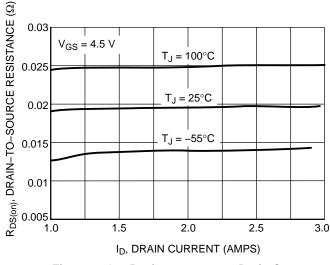


Figure 1. On-Region Characteristics

V_{GS}, GATE-TO-SOURCE VOLTAGE (VOLTS)

Figure 2. Transfer Characteristics



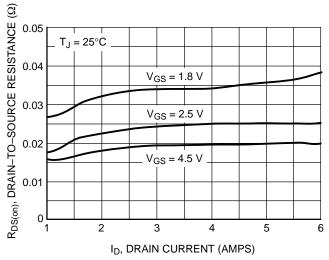
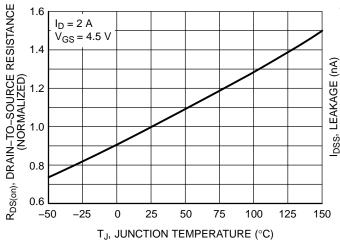


Figure 3. On-Resistance versus Drain Current

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



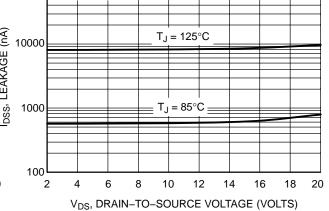


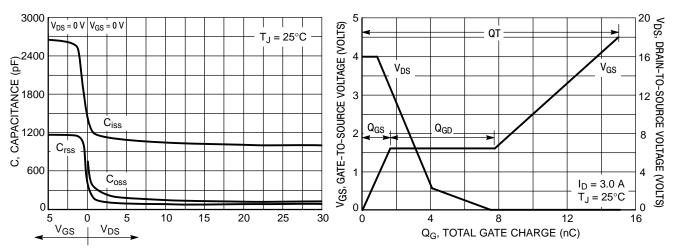
Figure 5. On–Resistance Variation with Temperature

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

100000

 $V_{GS} = 0 V$

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



GATE-TO-SOURCE OR DRAIN-TO-SOURCE VOLTAGE (VOLTS)

Figure 7. Capacitance Variation

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

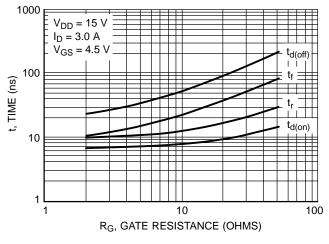


Figure 9. Resistive Switching Time Variation versus Gate Resistance

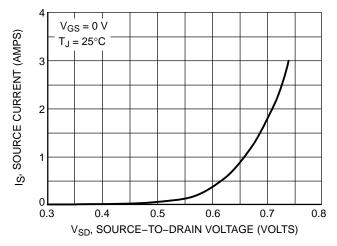


Figure 10. Diode Forward Voltage versus Current

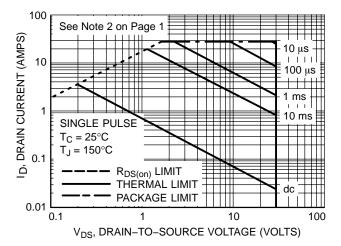


Figure 11. Maximum Rated Forward Biased Safe Operating Area

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

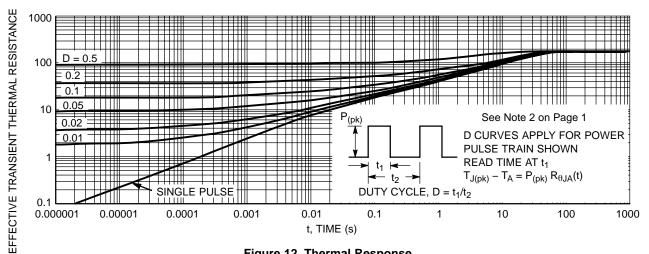
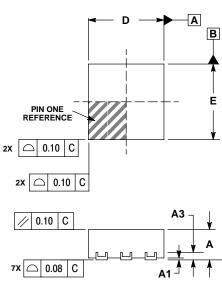


Figure 12. Thermal Response

PACKAGE DIMENSIONS

WDFN6, 2x2 CASE 506AP-01 ISSUE A

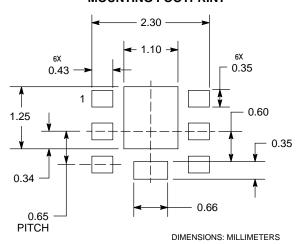


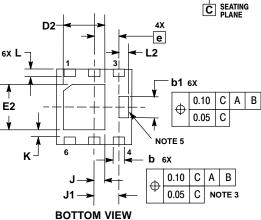
NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
- 2. CONTROLLING DIMENSION: MILLIMETERS
- 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.
- 5. CENTER TERMINAL LEAD IS OPTIONAL TERMINAL LEAD IS CONNECTED TO TERMINAL LEAD # 4.
- 6. PINS 1, 2, 5 AND 6 ARE TIED TO THE FLAG.

| | MILLIMETERS | | | |
|-----|-------------|------|--|--|
| DIM | MIN | MAX | | |
| Α | 0.70 | 0.80 | | |
| A1 | 0.00 | 0.05 | | |
| A3 | 0.20 REF | | | |
| b | 0.25 | 0.35 | | |
| b1 | 0.51 | 0.61 | | |
| D | 2.00 BSC | | | |
| D2 | 1.00 | 1.20 | | |
| E | 2.00 BSC | | | |
| E2 | 1.10 | 1.30 | | |
| е | 0.65 BSC | | | |
| K | 0.15 REF | | | |
| L | 0.20 | 0.30 | | |
| L2 | 0.20 | 0.30 | | |
| J | 0.27 REF | | | |
| J1 | 0.65 REF | | | |

SOLDERMASK DEFINED MOUNTING FOOTPRINT





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