

# NTLJS4149P

## Power MOSFET

-30 V, -5.9 A,  $\mu$ Cool™ Single P-Channel, 2x2 mm, WDFN Package

### Features

- WDFN Package with Exposed Drain Pad for Excellent Thermal Conduction
- 2x2 mm Footprint Same as SC-88 Package
- Low Profile (< 0.8 mm) for Easy Fit in Thin Environments
- This is a Pb-Free Device

### Applications

- Li Ion Battery Linear Mode Charging for Portable Power Management in Noisy Environment
- DC-DC Conversion Buck/Boost Circuits
- High Side Switching

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

| Parameter                                                         |                        |                       | Symbol                            | Value          | Unit |
|-------------------------------------------------------------------|------------------------|-----------------------|-----------------------------------|----------------|------|
| Drain-to-Source Voltage                                           |                        |                       | V <sub>DSS</sub>                  | -30            | V    |
| Gate-to-Source Voltage                                            |                        |                       | V <sub>GS</sub>                   | ±12            | V    |
| Continuous Drain Current (Note 1)                                 | Steady State           | T <sub>A</sub> = 25°C | I <sub>D</sub>                    | -4.5           | A    |
|                                                                   |                        | T <sub>A</sub> = 85°C |                                   | -3.3           |      |
|                                                                   | t ≤ 5 s                | T <sub>A</sub> = 25°C |                                   | -5.9           |      |
| Power Dissipation (Note 1)                                        | Steady State           | T <sub>A</sub> = 25°C | P <sub>D</sub>                    | 1.9            | W    |
|                                                                   | t ≤ 5 s                |                       |                                   | 3.2            |      |
| Continuous Drain Current (Note 2)                                 | Steady State           | T <sub>A</sub> = 25°C | I <sub>D</sub>                    | -2.7           | A    |
|                                                                   |                        | T <sub>A</sub> = 85°C |                                   | -2.0           |      |
| Power Dissipation (Note 2)                                        |                        |                       | T <sub>A</sub> = 25°C             | P <sub>D</sub> | 0.7  |
| Pulsed Drain Current                                              | t <sub>p</sub> = 10 μs |                       | I <sub>DM</sub>                   | -18            | A    |
| Operating Junction and Storage Temperature                        |                        |                       | T <sub>J</sub> , T <sub>STG</sub> | -55 to 150     | °C   |
| Source Current (Body Diode) (Note 2)                              |                        |                       | I <sub>S</sub>                    | -1.5           | A    |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) |                        |                       | T <sub>L</sub>                    | 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.

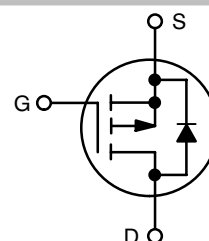
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).
2. Surface Mounted on FR4 Board using the minimum recommended pad size.



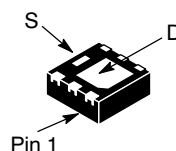
ON Semiconductor®

<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(on)} \text{ MAX}$ |
|---------------|--------------------------|
| -30 V         | 62 m $\Omega$ @ -4.5 V   |
|               | 75 m $\Omega$ @ -2.5 V   |



P-CHANNEL MOSFET



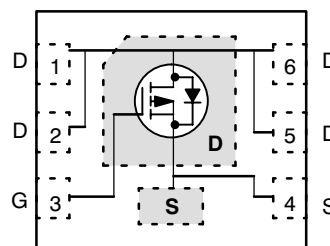
### MARKING DIAGRAM

|    |   |   |   |
|----|---|---|---|
| 1  | 2 | 3 | 4 |
| J9 | M | ■ |   |

J9 = 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†        |
|---------------|-----------------|------------------|
| NTLJS4149PTAG | WDFN6 (Pb-Free) | 3000/Tape & Reel |
| NTLJS4149PTBG | 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)         | $R_{\theta JA}$ | 65  | °C/W |
| Junction-to-Ambient – $t \leq 5$ s (Note 3)         | $R_{\theta JA}$ | 38  |      |
| Junction-to-Ambient – Steady State Min Pad (Note 4) | $R_{\theta JA}$ | 180 |      |

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.

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

| Parameter                                                 | Symbol            | Test Conditions                                             | Min                      | Typ  | Max       | Unit          |
|-----------------------------------------------------------|-------------------|-------------------------------------------------------------|--------------------------|------|-----------|---------------|
| <b>OFF CHARACTERISTICS</b>                                |                   |                                                             |                          |      |           |               |
| Drain-to-Source Breakdown Voltage                         | $V_{(BR)DSS}$     | $V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$        | -30                      |      |           | V             |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $I_D = -250\text{ }\mu\text{A}$ , Ref to $25^\circ\text{C}$ |                          | -1.8 |           | mV/°C         |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | $V_{DS} = -24\text{ V}, V_{GS} = 0\text{ V}$                | $T_J = 25^\circ\text{C}$ | -0.1 | -1.0      | $\mu\text{A}$ |
|                                                           |                   |                                                             | $T_J = 85^\circ\text{C}$ | -1.0 | -10       |               |
| Gate-to-Source Leakage Current                            | $I_{GSS}$         | $V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$             |                          |      | $\pm 0.1$ | $\mu\text{A}$ |

# ON CHARACTERISTICS (Note 5)

|                                            |                  |                                                  |      |     |      |            |
|--------------------------------------------|------------------|--------------------------------------------------|------|-----|------|------------|
| Gate Threshold Voltage                     | $V_{GS(TH)}$     | $V_{GS} = V_{DS}, I_D = -250\text{ }\mu\text{A}$ | -0.4 |     | -1.0 | V          |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ |                                                  |      | 3.1 |      | mV/°C      |
| Drain-to-Source On-Resistance              | $R_{DS(on)}$     | $V_{GS} = -4.5\text{ V}, I_D = -2.0\text{ A}$    |      | 43  | 62   | m $\Omega$ |
|                                            |                  | $V_{GS} = -2.5\text{ V}, I_D = -2.0\text{ A}$    |      | 56  | 75   |            |
|                                            |                  | $V_{GS} = -4.5\text{ V}, I_D = -4.5\text{ A}$    |      | 43  | 62   |            |
| Forward Transconductance                   | $g_{FS}$         | $V_{DS} = -6.0\text{ V}, I_D = -3.0\text{ A}$    |      | 10  |      | S          |

# CHARGES, CAPACITANCES AND GATE RESISTANCE

|                              |              |                                                                      |  |      |    |    |
|------------------------------|--------------|----------------------------------------------------------------------|--|------|----|----|
| Input Capacitance            | $C_{ISS}$    | $V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = -15\text{ V}$     |  | 960  |    | pF |
| Output Capacitance           | $C_{OSS}$    |                                                                      |  | 130  |    |    |
| Reverse Transfer Capacitance | $C_{RSS}$    |                                                                      |  | 80   |    |    |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = -4.5\text{ V}, V_{DS} = -15\text{ V}, I_D = -2.0\text{ A}$ |  | 9.9  | 15 | nC |
| Threshold Gate Charge        | $Q_{G(TH)}$  |                                                                      |  | 0.8  |    |    |
| Gate-to-Source Charge        | $Q_{GS}$     |                                                                      |  | 1.45 |    |    |
| Gate-to-Drain Charge         | $Q_{GD}$     |                                                                      |  | 2.75 |    |    |

# SWITCHING CHARACTERISTICS (Note 6)

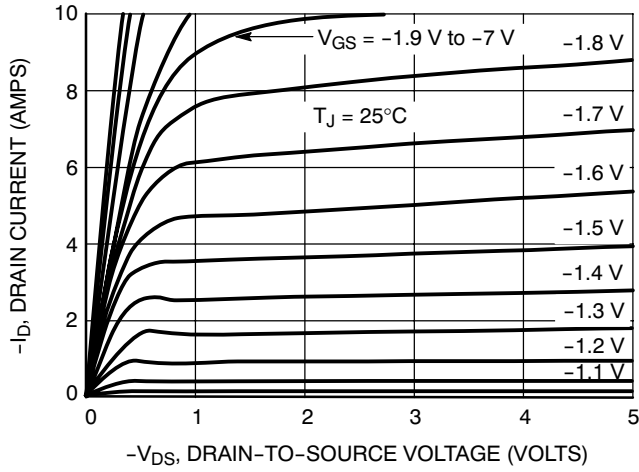
|                     |              |                                                                                               |  |     |  |    |
|---------------------|--------------|-----------------------------------------------------------------------------------------------|--|-----|--|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = -4.5\text{ V}, V_{DS} = -15\text{ V}, I_D = -2.0\text{ A}, R_G = 2.0\text{ }\Omega$ |  | 6.9 |  | ns |
| Rise Time           | $t_r$        |                                                                                               |  | 11  |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |                                                                                               |  | 60  |  |    |
| Fall Time           | $t_f$        |                                                                                               |  | 55  |  |    |

# DRAIN-SOURCE DIODE CHARACTERISTICS

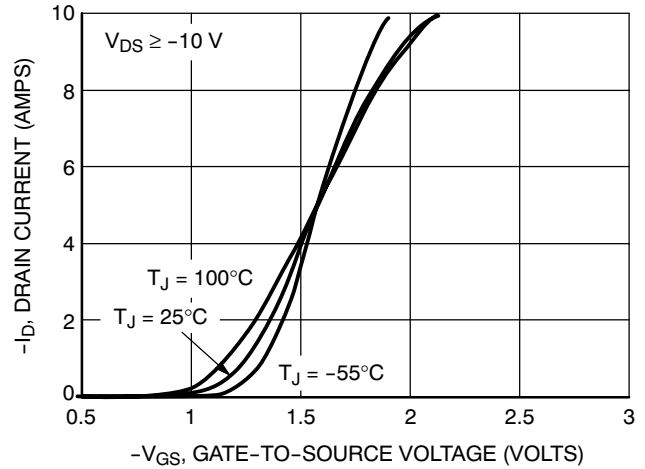
|                         |          |                                                                                |                          |       |      |    |
|-------------------------|----------|--------------------------------------------------------------------------------|--------------------------|-------|------|----|
| Forward Diode Voltage   | $V_{SD}$ | $V_{GS} = 0\text{ V}, I_S = -1.5\text{ A}$                                     | $T_J = 25^\circ\text{C}$ | -0.75 | -1.2 | V  |
|                         |          |                                                                                | $T_J = 85^\circ\text{C}$ | -0.65 |      |    |
| Reverse Recovery Time   | $t_{RR}$ | $V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}, I_S = -1.5\text{ A}$ |                          | 35    | 60   | ns |
| Charge Time             | $t_a$    |                                                                                |                          | 10    |      |    |
| Discharge Time          | $t_b$    |                                                                                |                          | 25    |      |    |
| Reverse Recovery Charge | $Q_{RR}$ |                                                                                |                          | 0.016 |      |    |

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

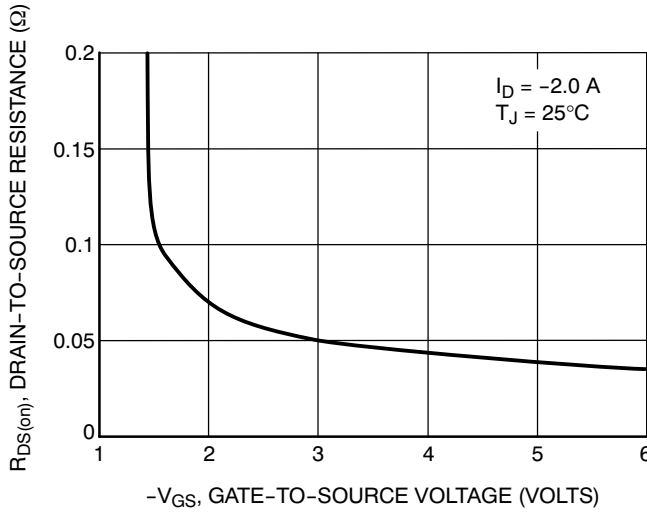
**TYPICAL PERFORMANCE CURVES** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)



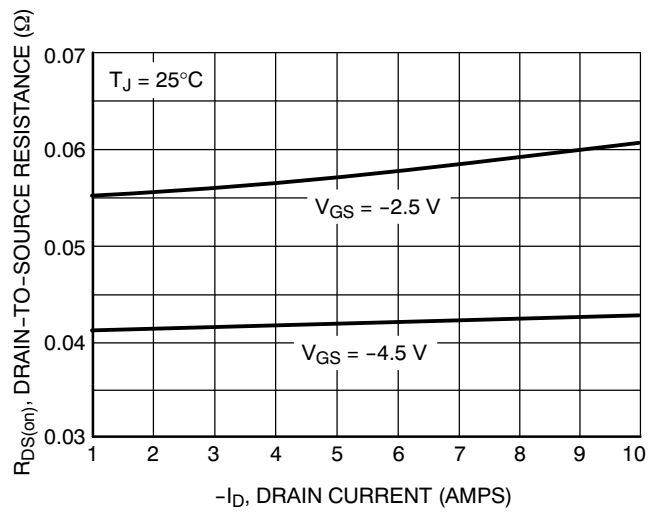
**Figure 1. On-Region Characteristics**



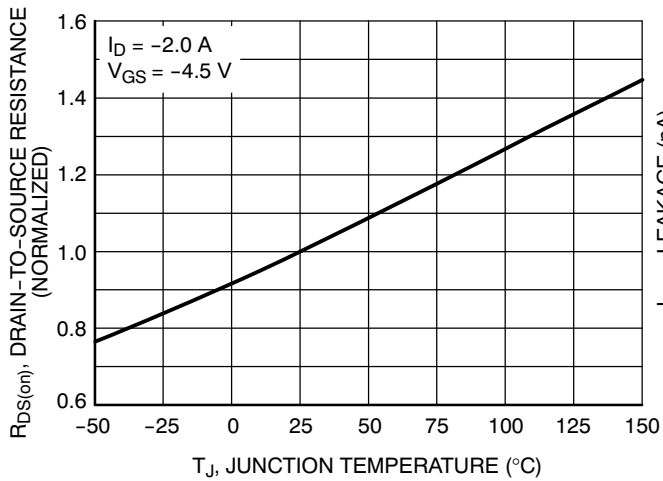
**Figure 2. Transfer Characteristics**



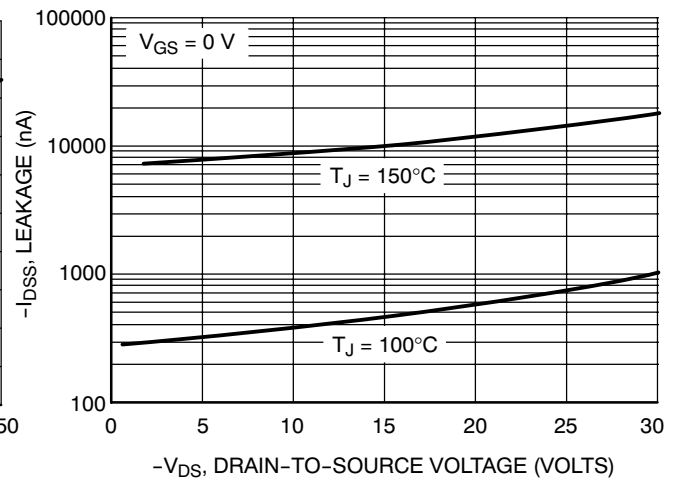
**Figure 3. On-Resistance versus Gate-to-Source Voltage**



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

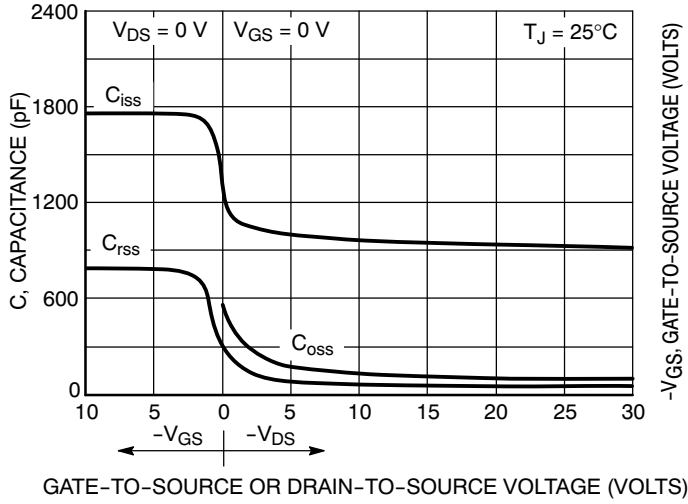


**Figure 5. On-Resistance Variation with Temperature**

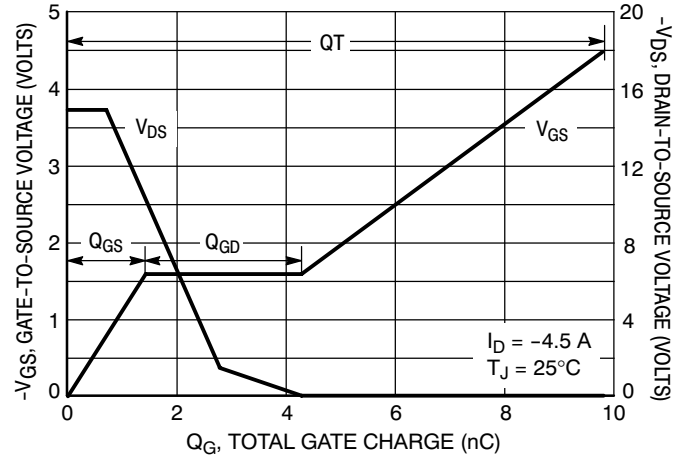


**Figure 6. Drain-to-Source Leakage Current versus Voltage**

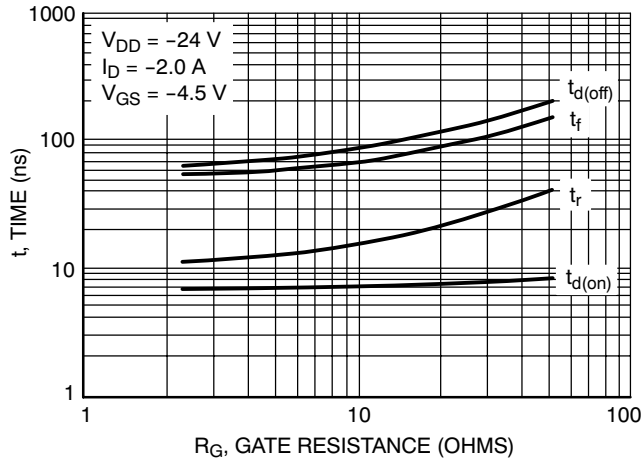
**TYPICAL PERFORMANCE CURVES** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)



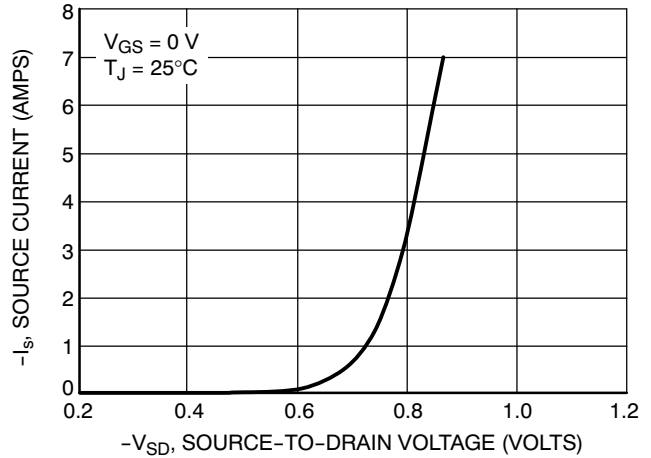
**Figure 7. Capacitance Variation**



**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**



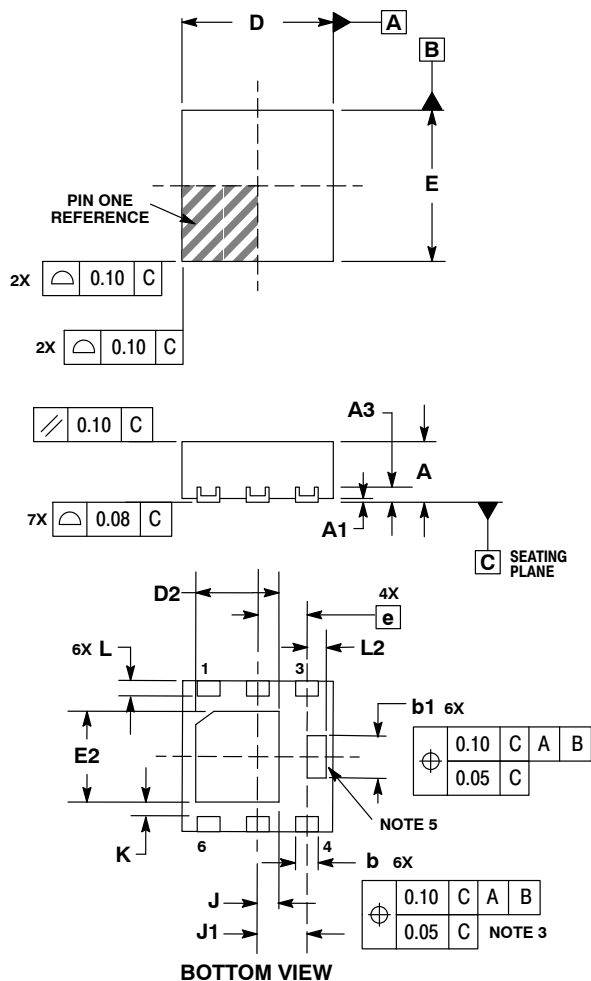
SCALE 4:1

### WDFN6 2x2

#### CASE 506AP-01

#### ISSUE B

DATE 26 APR 2006



STYLE 1:  
PIN 1: DRAIN  
2: DRAIN  
3: GATE  
4: SOURCE  
5: DRAIN  
6: DRAIN

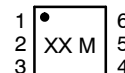
STYLE 2:  
PIN 1: COLLECTOR  
2: COLLECTOR  
3: BASE  
4: EMITTER  
5: COLLECTOR  
6: COLLECTOR

#### 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.
1. CENTER TERMINAL LEAD IS OPTIONAL. TERMINAL LEAD IS CONNECTED TO TERMINAL LEAD # 4.
2. PINS 1, 2, 5 AND 6 ARE TIED TO THE FLAG.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 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 |
| e   | 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    |      |

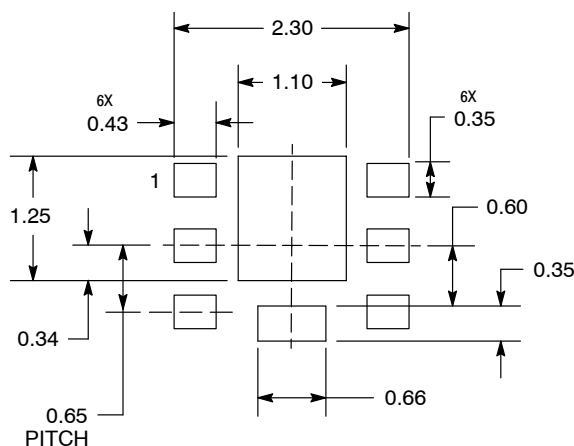
#### GENERIC MARKING DIAGRAM\*



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.

#### SOLDERMASK DEFINED MOUNTING FOOTPRINT



DIMENSIONS: MILLIMETERS

|                  |                       |                                                                                                                                                                                  |
|------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DOCUMENT NUMBER: | 98AON20860D           | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION:     | 6 PIN WDFN 2X2, 0.65P | PAGE 1 OF 1                                                                                                                                                                      |

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