

# NTLJS3113P

## MOSFET – Power, Single, P-Channel, WDFN, 2X2 mm -20 V, -7.7 A

### Features

- **Recommended Replacement Device – NTLUS3A40P**
- WDFN Package Provides Exposed Drain Pad for Excellent Thermal Conduction
- 2x2 mm Footprint Same as SC-88 Package
- Lowest  $R_{DS(on)}$  Solution in 2x2 mm Package
- 1.5 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
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

- DC-DC Converters (Buck and Boost Circuits)
- Optimized for Battery and Load Management Applications in Portable Equipment such as, Cell Phones, PDA's, Media Players, etc.
- High Side Load Switch

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

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V <sub>DSS</sub>	−20	V
Gate-to-Source Voltage			V <sub>GS</sub>	±8.0	V
Continuous Drain Current (Note 1)	Steady State	T <sub>A</sub> = 25°C	I <sub>D</sub>	−5.8	A
		T <sub>A</sub> = 85°C		−4.4	
	t ≤ 5 s	T <sub>A</sub> = 25°C		−7.7	
Power Dissipation (Note 1)	Steady State	T <sub>A</sub> = 25°C	P <sub>D</sub>	1.9	W
	t ≤ 5 s			3.3	
Continuous Drain Current (Note 2)	Steady State	T <sub>A</sub> = 25°C	I <sub>D</sub>	−3.5	A
		T <sub>A</sub> = 85°C		−2.5	
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>	−23	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>	−2.8	A
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.

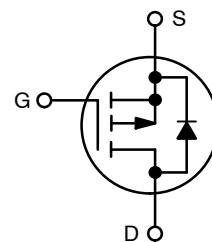
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).
2. Surface Mounted on FR4 Board using the minimum recommended pad size, (30 mm<sup>2</sup>, 2 oz Cu).



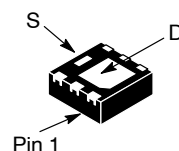
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$V_{(BR)DS}$	$R_{DS(on)}$ MAX	$I_D$ MAX (Note 1)
-20 V	40 mΩ @ -4.5 V	-7.7 A
	50 mΩ @ -2.5 V	
	75 mΩ @ -1.8 V	
	200 mΩ @ -1.5 V	



P-CHANNEL MOSFET



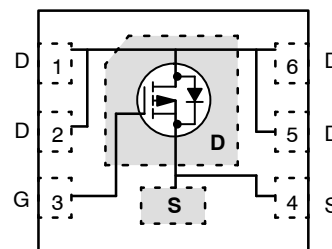
WDFN6  
CASE 506AP

### MARKING DIAGRAM

1	6
2	5
3	4

J8 = 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†
NTLJS3113PT1G	WDFN6	3000/Tape & Reel
NTLJS3113PTAG	(Pb-Free)	

†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 (30 mm<sup>2</sup>, 2 oz Cu).

# 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	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-20			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = -250\text{ }\mu\text{A}$ , Ref to $25^\circ\text{C}$		-10.1		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$	$T_J = 25^\circ\text{C}$		-1.0	$\mu\text{A}$
			$T_J = 85^\circ\text{C}$		-10	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8.0\text{ V}$			$\pm 1.0$	$\mu\text{A}$

# ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = -250\text{ }\mu\text{A}$	-0.45	-0.67	-1.0	V
Negative Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			2.68		mV/°C
Drain-to-Source On-Resistance	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -3.0\text{ A}$		32	40	m $\Omega$
		$V_{GS} = -2.5\text{ V}, I_D = -3.0\text{ A}$		44	50	
		$V_{GS} = -1.8\text{ V}, I_D = -2.0\text{ A}$		67	75	
		$V_{GS} = -1.5\text{ V}, I_D = -1.8\text{ A}$		90	200	
Forward Transconductance	$g_{FS}$	$V_{DS} = -16\text{ V}, I_D = -3.0\text{ A}$		5.9		S

# CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = -16\text{ V}$		1329		pF
Output Capacitance	$C_{OSS}$			213		
Reverse Transfer Capacitance	$C_{RSS}$			120		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -4.5\text{ V}, V_{DS} = -16\text{ V}, I_D = -3.0\text{ A}$		13	15.7	nC
Threshold Gate Charge	$Q_{G(TH)}$			1.5		
Gate-to-Source Charge	$Q_{GS}$			2.2		
Gate-to-Drain Charge	$Q_{GD}$			2.9		
Gate Resistance	$R_G$			14.4		$\Omega$

# SWITCHING CHARACTERISTICS (Note 6)

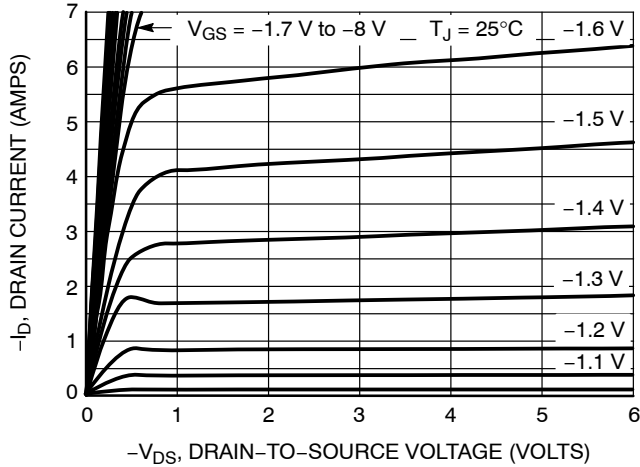
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -4.5\text{ V}, V_{DD} = -10\text{ V}, I_D = -3.0\text{ A}, R_G = 3.0\text{ }\Omega$		6.9		ns
Rise Time	$t_r$			17.5		
Turn-Off Delay Time	$t_{d(OFF)}$			60		
Fall Time	$t_f$			56.5		

# DRAIN-SOURCE DIODE CHARACTERISTICS

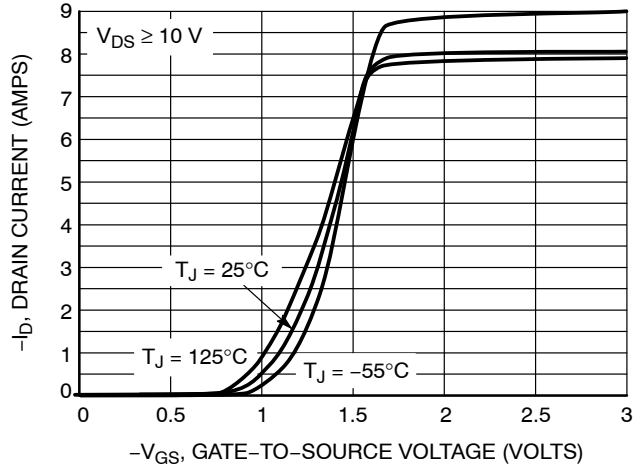
Forward Recovery Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = -1.0\text{ A}$	$T_J = 25^\circ\text{C}$	-0.78	-1.2	V
			$T_J = 125^\circ\text{C}$	-0.67		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, dI_{SD}/dt_i = 100\text{ A}/\mu\text{s}, I_S = -1.0\text{ A}$		70.8	106	ns
Charge Time	$t_a$			14.3		
Discharge Time	$t_b$			56.4		
Reverse Recovery Time	$Q_{RR}$			44		nC

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

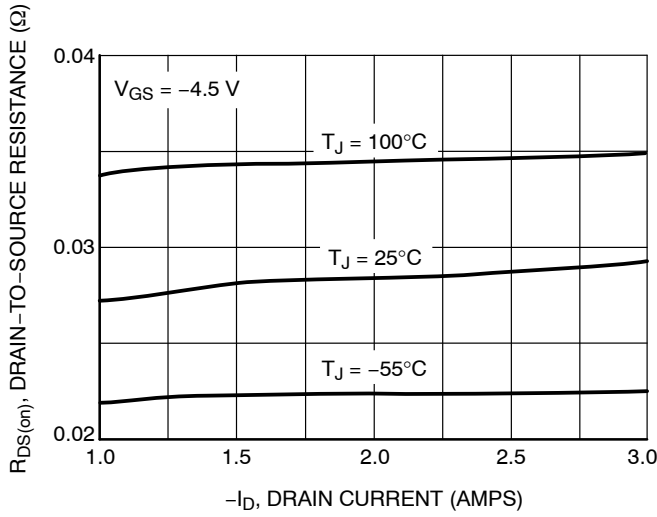
**TYPICAL PERFORMANCE CURVES** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)



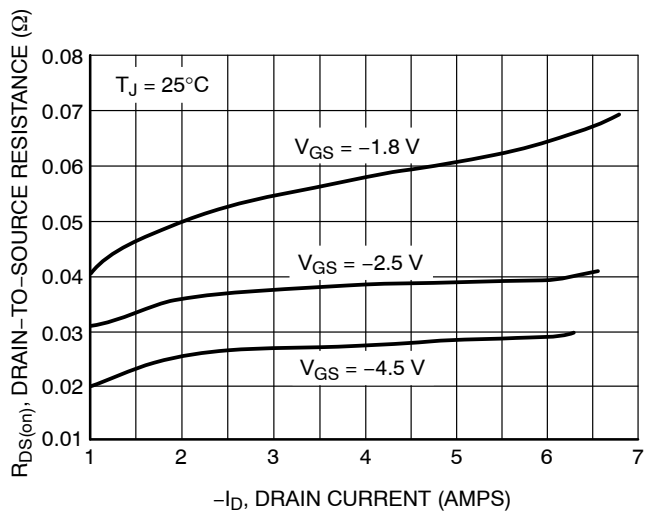
**Figure 1. On-Region Characteristics**



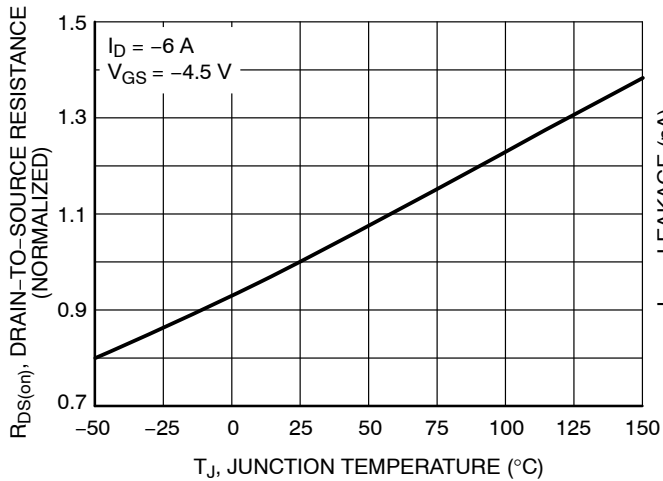
**Figure 2. Transfer Characteristics**



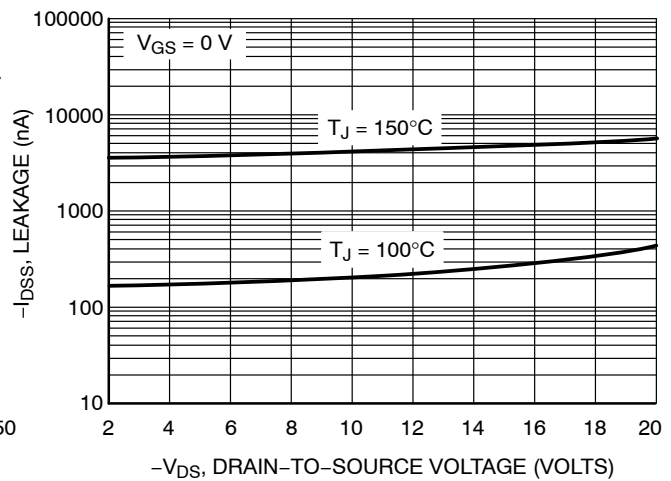
**Figure 3. On-Resistance versus Drain Current**



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

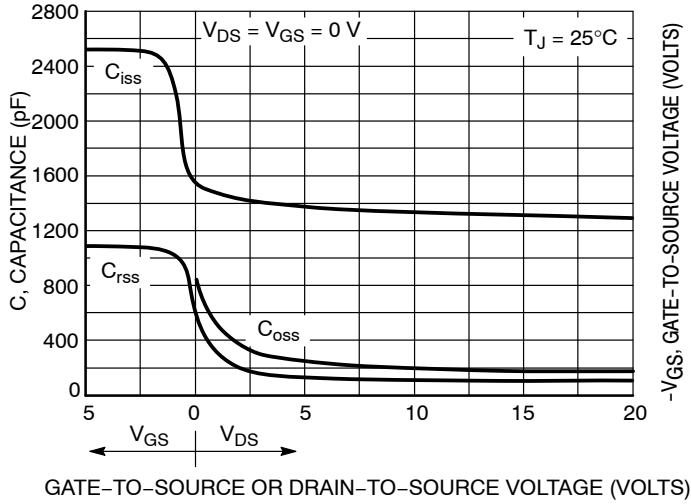


Figure 7. Capacitance Variation

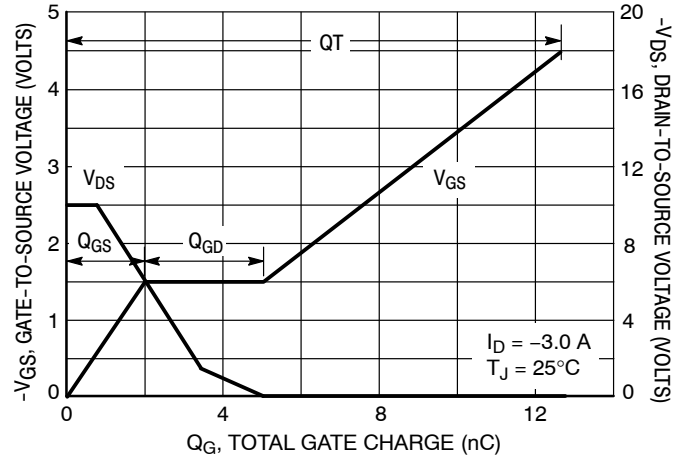


Figure 8. Gate-To-Source and Drain-To-Source Voltage versus Total Charge

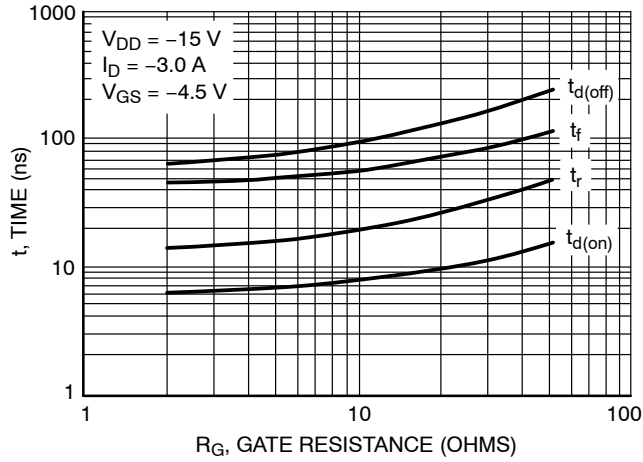


Figure 9. Resistive Switching Time Variation versus Gate Resistance

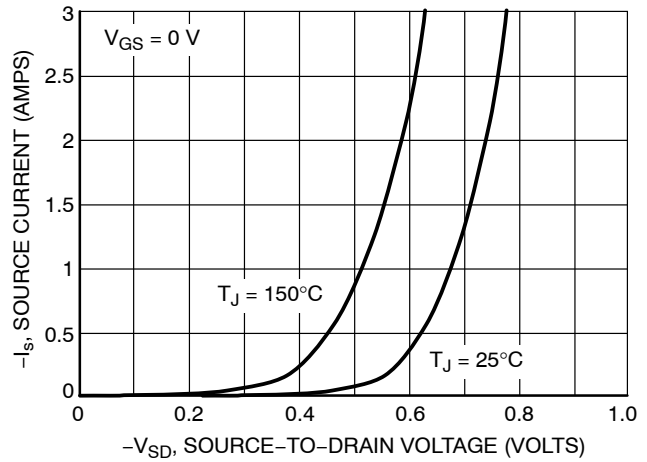


Figure 10. Diode Forward Voltage versus Current

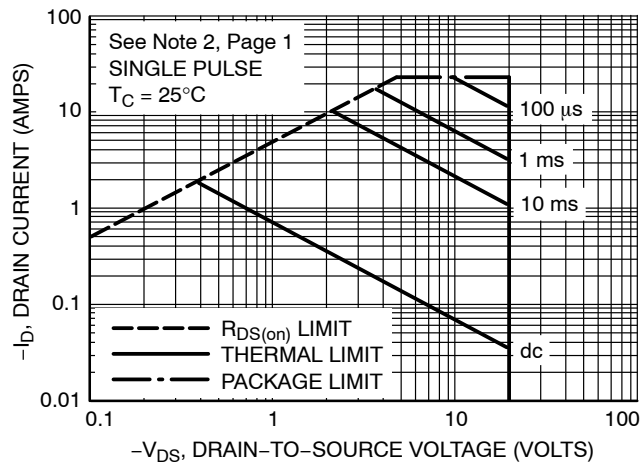


Figure 11. Maximum Rated Forward Biased Safe Operating Area

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

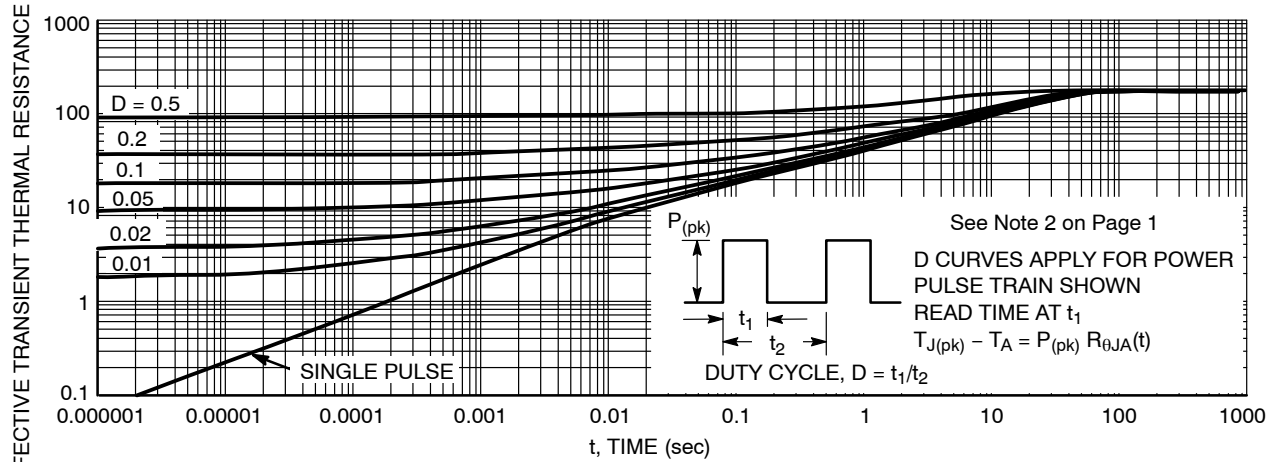
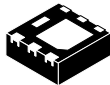


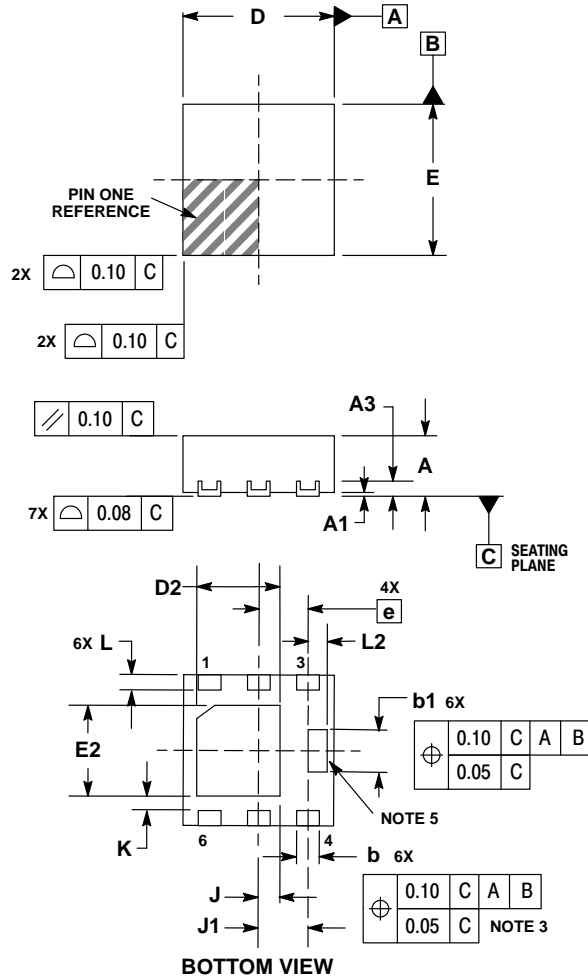
Figure 12. Thermal Response



WDFN6 2x2  
CASE 506AP  
ISSUE B

DATE 26 APR 2006

SCALE 4:1

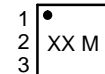


NOTES:

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	

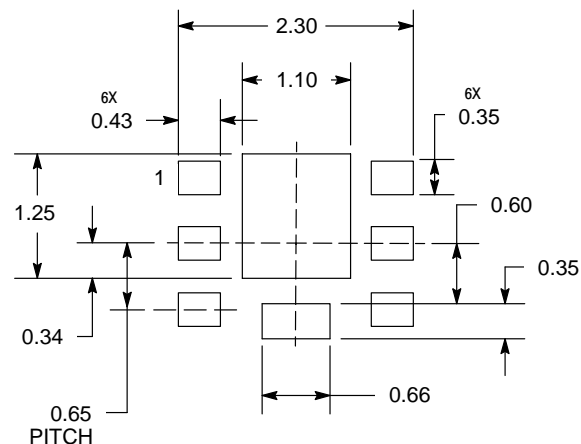
GENERIC  
MARKING DIAGRAM\*



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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