

# NTLJS3180PZ

## Power MOSFET

-20 V, -7.7 A,  $\mu$ Cool™ Single P-Channel, ESD, 2x2 mm WDFN Package

### Features

- WDFN 2x2 mm Package with Exposed Drain Pads for Excellent Thermal Conduction
- Lowest  $R_{DS(on)}$  Solution in 2x2 mm Package
- Footprint Same as SC-88 Package
- Low Profile (< 0.8 mm) for Easy Fit in Thin Environments
- ESD Protected
- This is a Pb-Free Device

### Applications

- Optimized for Battery and Load Management Applications in Portable Equipment
- High Side Load Switch
- Battery Switch
- DC-DC Converters

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

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		$V_{DSS}$	-20	V
Gate-to-Source Voltage		$V_{GS}$	$\pm 8.0$	V
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	-5.9	A
		$T_A = 85^\circ\text{C}$	-4.2	
	$t \leq 5 \text{ s}$	$T_A = 25^\circ\text{C}$	-7.7	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	1.9	W
			$t \leq 5 \text{ s}$	
Continuous Drain Current (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	-3.5	A
		$T_A = 85^\circ\text{C}$	-2.5	
Power Dissipation (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	0.7	W
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	$I_{DM}$	-23	A
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$
Source Current (Body Diode) (Note 2)		$I_S$	-2.8	A
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$

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.

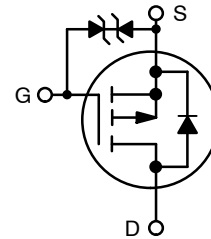
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).
2. Surface Mounted on FR4 Board using the minimum recommended pad size, (30 mm<sup>2</sup>, 2 oz Cu).



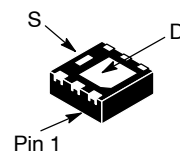
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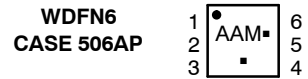
$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
-20 V	38 m $\Omega$ @ -4.5 V	-7.7 A
	50 m $\Omega$ @ -2.5 V	
	75 m $\Omega$ @ -1.8 V	
	200 m $\Omega$ @ -1.5 V	



P-CHANNEL MOSFET

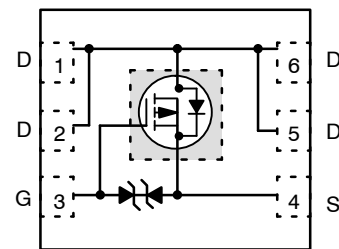


### MARKING DIAGRAM



AA = 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†
NTLJS3180PZTAG	WDFN6	3000/Tape & Reel
NTLJS3180PZTBG	(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.

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## THERMAL RESISTANCE RATINGS

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

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
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-20			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = -250\ \mu\text{A}$ , Ref to $25^\circ\text{C}$		-5.0		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$			-1.0	$\mu\text{A}$
					-10	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8.0\text{ V}$			$\pm 10$	$\mu\text{A}$

### ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$	-0.45		-1.0	V
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			3.0		mV/°C
Drain-to-Source On-Resistance	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -3.0\text{ A}$		30	38	m $\Omega$
		$V_{GS} = -2.5\text{ V}, I_D = -3.0\text{ A}$		40	50	
		$V_{GS} = -1.8\text{ V}, I_D = -2.0\text{ A}$		55	75	
		$V_{GS} = -1.5\text{ V}, I_D = -1.8\text{ A}$		85	200	
Forward Transconductance	$g_{FS}$	$V_{DS} = -16\text{ V}, I_D = -3.0\text{ A}$		7.7		S

### CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = -16\text{ V}$		1100		pF
Output Capacitance	$C_{OSS}$			180		
Reverse Transfer Capacitance	$C_{RSS}$			130		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -4.5\text{ V}, V_{DS} = -16\text{ V}, I_D = -3.0\text{ A}$		13	19.5	nC
Threshold Gate Charge	$Q_{G(TH)}$			0.5		
Gate-to-Source Charge	$Q_{GS}$			1.4		
Gate-to-Drain Charge	$Q_{GD}$			4.2		

### SWITCHING CHARACTERISTICS (Note 6)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -4.5\text{ V}, V_{DD} = -10\text{ V}, I_D = -3.0\text{ A}, R_G = 3.0\ \Omega$		8.0		ns
Rise Time	$t_r$			15		
Turn-Off Delay Time	$t_{d(OFF)}$			70		
Fall Time	$t_f$			67		

### DRAIN-SOURCE DIODE CHARACTERISTICS

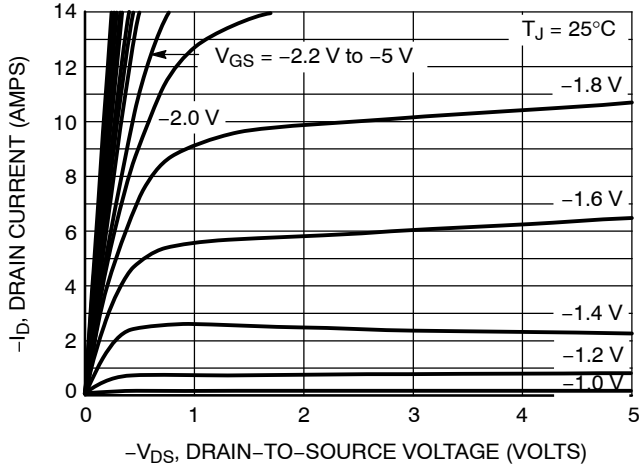
Forward Recovery Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = -2.0\text{ A}$	$T_J = 25^\circ\text{C}$		-0.7	-1.0	V
			$T_J = 125^\circ\text{C}$		-0.6		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, d_{ISD}/d_t = 100\text{ A}/\mu\text{s}, I_S = -2.0\text{ A}$			60		ns
Charge Time	$t_a$				16		
Discharge Time	$t_b$				44		
Reverse Recovery Time	$Q_{RR}$				41		nC

5. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

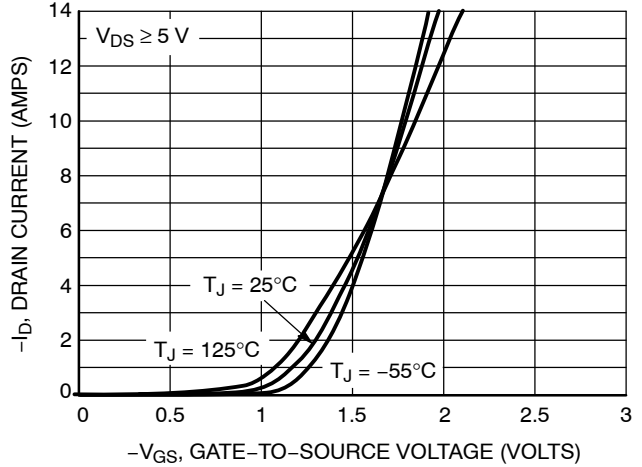
6. Switching characteristics are independent of operating junction temperatures.

# NTLJS3180PZ

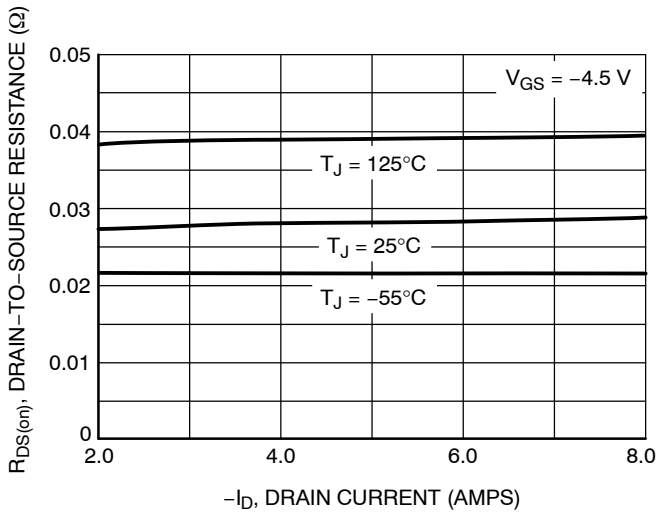
## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)



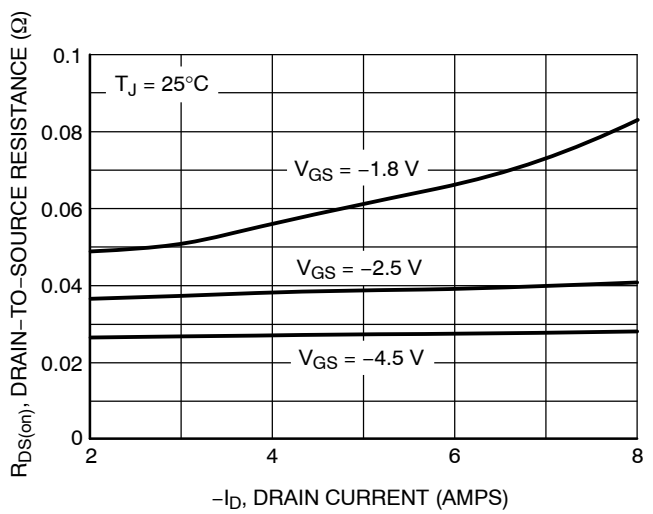
**Figure 1. On-Region Characteristics**



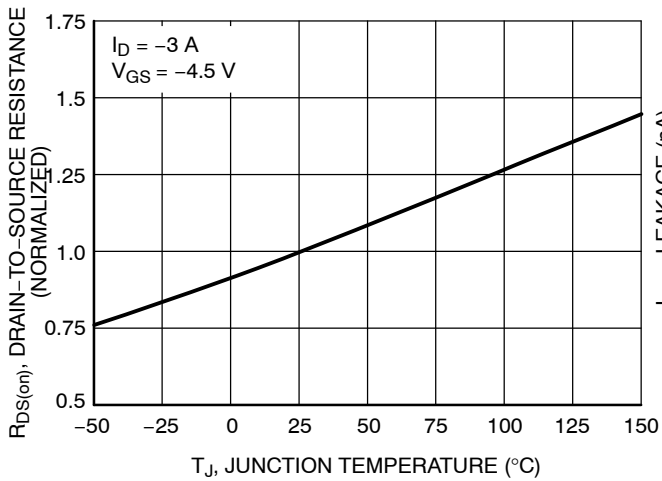
**Figure 2. Transfer Characteristics**



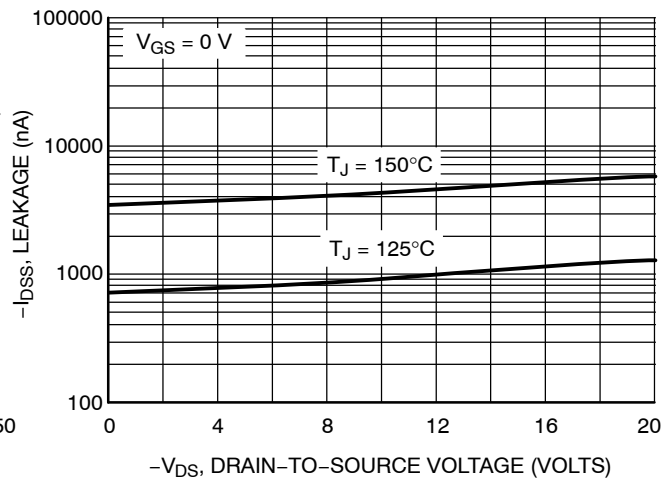
**Figure 3. On-Resistance versus Drain Current**



**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**

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

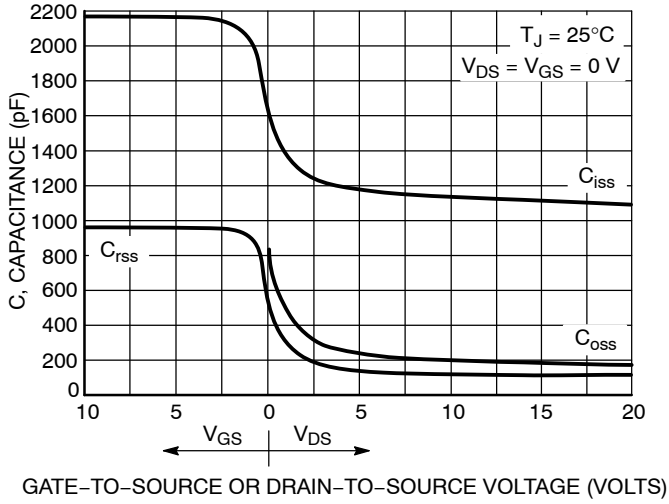


Figure 7. Capacitance Variation

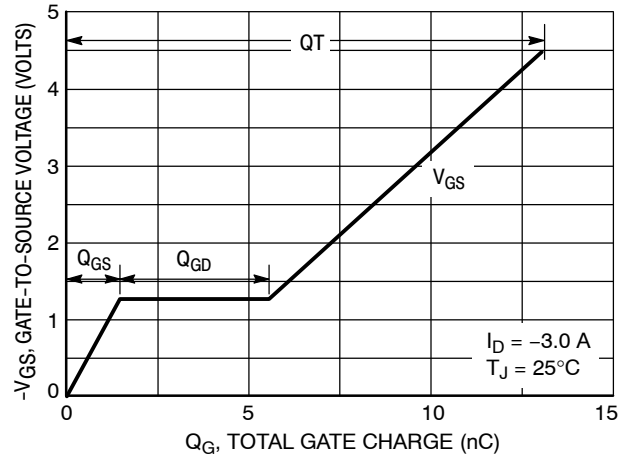


Figure 8. Gate-To-Source and Drain-To-Source Voltage versus Total Charge

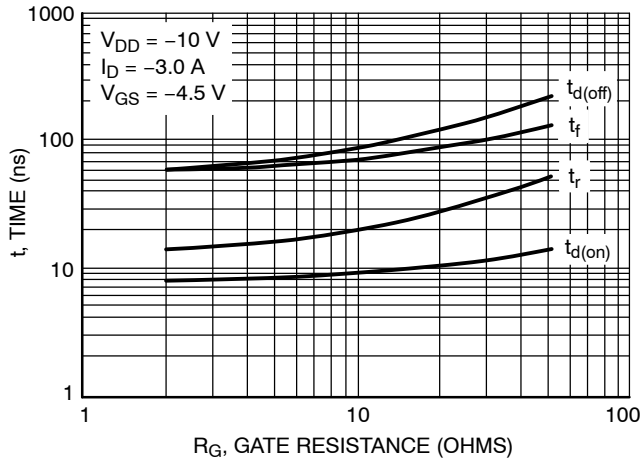


Figure 9. Resistive Switching Time Variation versus Gate Resistance

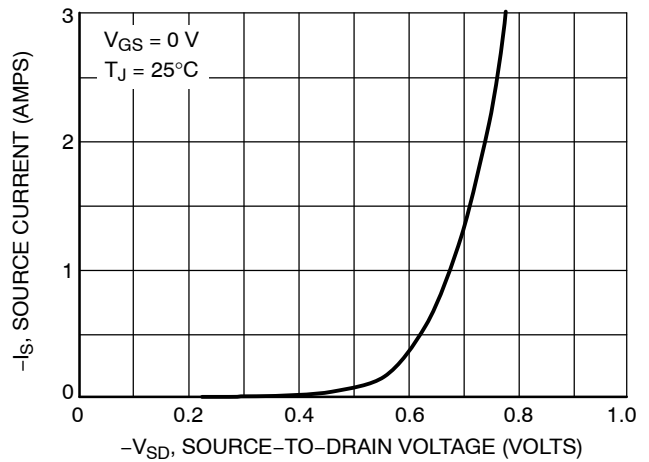


Figure 10. Diode Forward Voltage versus Current

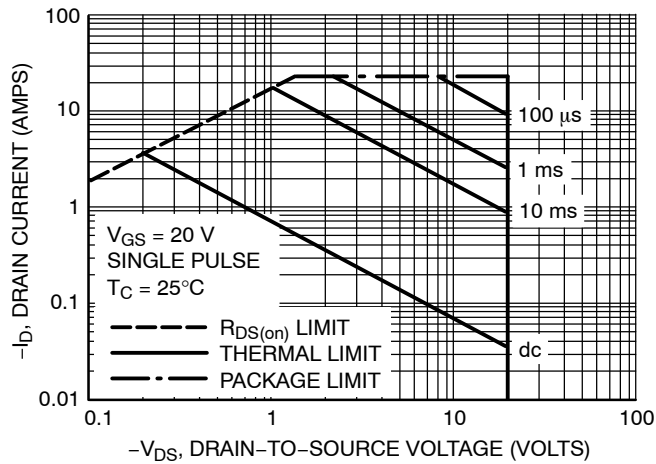


Figure 11. Maximum Rated Forward Biased Safe Operating Area

# NTLJS3180PZ

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

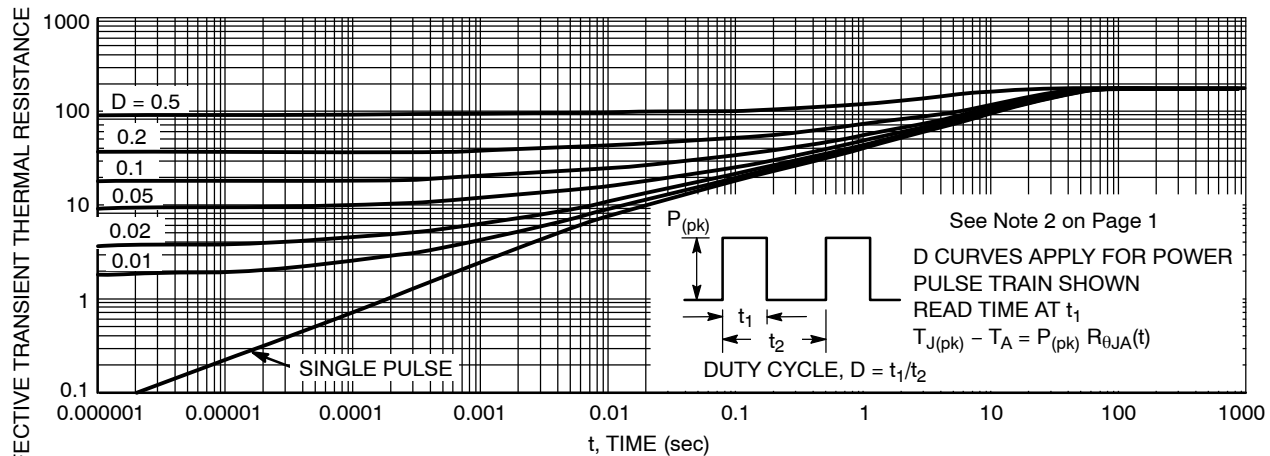


Figure 12. Thermal Response

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

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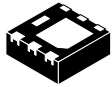


### WDFN6 2x2

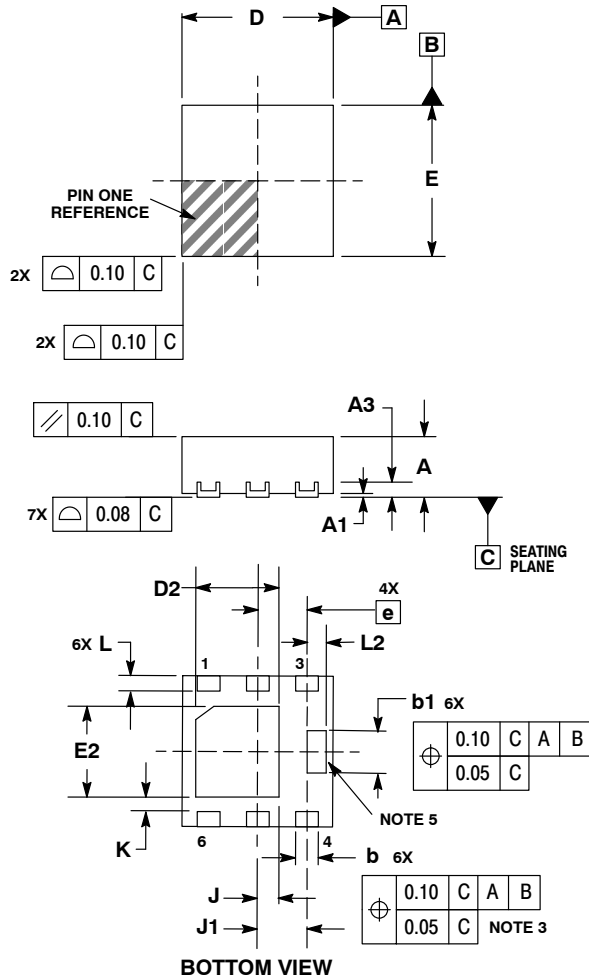
#### CASE 506AP-01

#### ISSUE B

DATE 26 APR 2006



SCALE 4:1



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

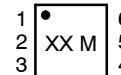
STYLE 2:  
 PIN 1. COLLECTOR  
 2. COLLECTOR  
 3. BASE  
 4. EMITTER  
 5. COLLECTOR  
 6. COLLECTOR

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	

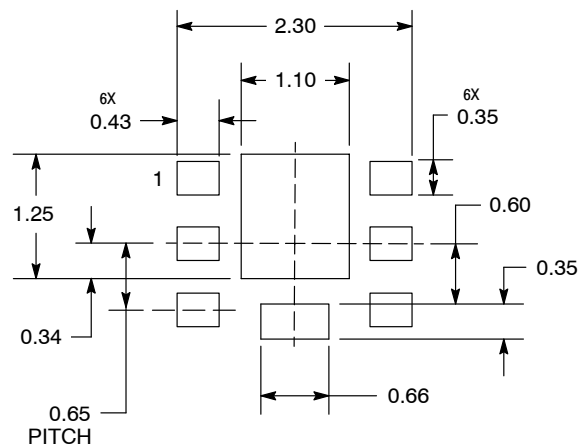
### GENERIC MARKING DIAGRAM\*



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

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<b>DESCRIPTION:</b>	<b>6 PIN WDFN 2X2, 0.65P</b>	<b>PAGE 1 OF 1</b>

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