

# MOSFET - Power, Dual N-Channel

## 60 V, 38 mΩ, 18 A

### NVLJWD040N06CL

#### Features

- Small Footprint for Compact Design
- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Wettable Flanks Product
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

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

Parameter		Symbol	Value	Unit	
Drain-to-Source Voltage		$V_{DSS}$	60	V	
Gate-to-Source Voltage		$V_{GS}$	$\pm 20$	V	
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 2, 3)	Steady State	$T_C = 25^\circ\text{C}$	$I_D$	18	A
		$T_C = 100^\circ\text{C}$		13	
Power Dissipation $R_{\theta JC}$ (Notes 1, 2)	Steady State	$T_C = 25^\circ\text{C}$	$P_D$	24	W
		$T_C = 100^\circ\text{C}$		12	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	5.5	A
		$T_A = 100^\circ\text{C}$		3.9	
Power Dissipation $R_{\theta JA}$ (Notes 1, 2)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	2.2	W
		$T_A = 100^\circ\text{C}$		1.1	
Pulsed Drain Current	$T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	$I_{DM}$	54	A	
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	-55 to +175	$^\circ\text{C}$	
Source Current (Body Diode)		$I_S$	20	A	
Single Pulse Drain-to-Source Avalanche Energy ( $I_{L(pk)} = 0.9 \text{ A}$ )		$E_{AS}$	27	mJ	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$	

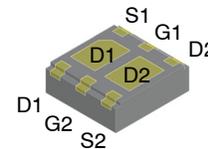
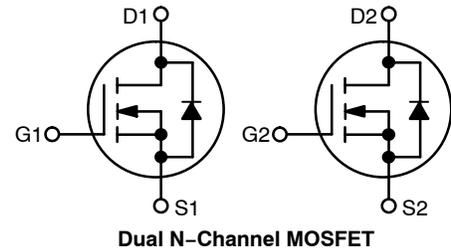
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

#### THERMAL RESISTANCE MAXIMUM RATINGS (Note 1)

Parameter	Symbol	Value	Unit
Junction-to-Case - Steady State (Note 2)	$R_{\theta JC}$	6.3	$^\circ\text{C}/\text{W}$
Junction-to-Ambient - Steady State (Note 2)	$R_{\theta JA}$	69	

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using a 650 mm<sup>2</sup>, 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
60 V	38 mΩ @ 10 V	18 A
	50 mΩ @ 4.5 V	



WDFNW6 (2.2x2.3)  
CASE 515AS

#### MARKING DIAGRAM



- 040N = Specific Device Code
- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week

#### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 5 of this data sheet.

# NVLJWD040N06CL

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			25		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$	$T_J = 25\ ^\circ\text{C}$		10	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		100	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			100	nA

## ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 13\ \mu\text{A}$	1.2		2.0	V
Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			-5.4		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 5\text{ A}$		31	38	m $\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 5\text{ A}$		40	50	
Forward Transconductance	$g_{FS}$	$V_{DS} = 10\text{ V}, I_D = 5\text{ A}$		14		S

## CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 25\text{ V}$		340		pF
Output Capacitance	$C_{OSS}$			145		
Reverse Transfer Capacitance	$C_{RSS}$			3		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 48\text{ V}; I_D = 5\text{ A}$		3		nC
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 48\text{ V}; I_D = 5\text{ A}$		6		nC
Threshold Gate Charge	$Q_{G(TH)}$			0.7		nC
Gate-to-Source Charge	$Q_{GS}$			1.3		
Gate-to-Drain Charge	$Q_{GD}$			0.6		
Plateau Voltage	$V_{GP}$			3		V

## SWITCHING CHARACTERISTICS (Note 5)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DS} = 48\text{ V}, I_D = 5\text{ A}, R_G = 6\ \Omega$		4.8		ns
Rise Time	$t_r$			1.4		
Turn-Off Delay Time	$t_{d(OFF)}$			12.1		
Fall Time	$t_f$			1.8		

## DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 5\text{ A}$	$T_J = 25^\circ\text{C}$		0.88	1.2	V
			$T_J = 125^\circ\text{C}$		0.77		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s}, I_S = 5\text{ A}$		20		ns	
Charge Time	$t_a$			11			
Discharge Time	$t_b$			9			
Reverse Recovery Charge	$Q_{RR}$			10			nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

5. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

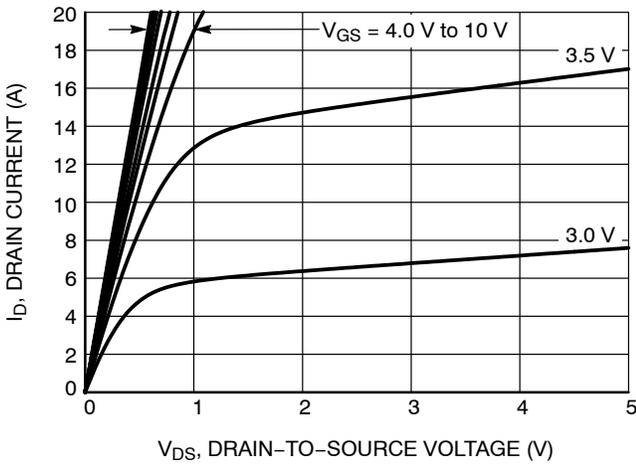


Figure 1. On-Region Characteristics

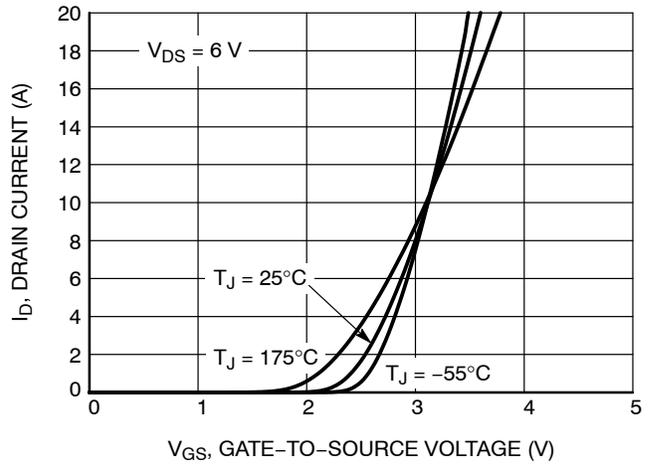


Figure 2. Transfer Characteristics

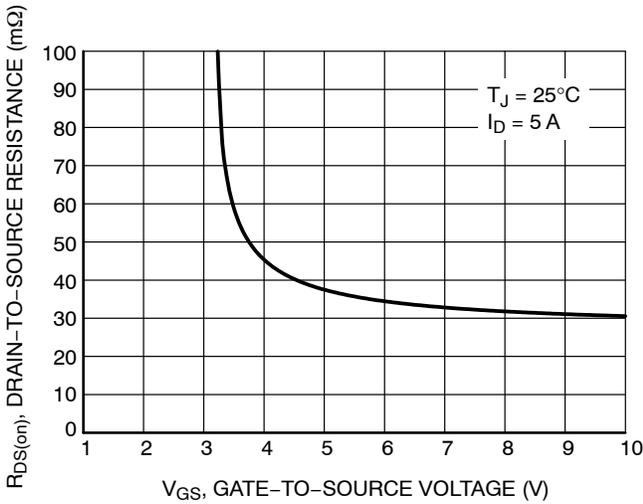


Figure 3. On-Resistance vs. Gate-to-Source Voltage

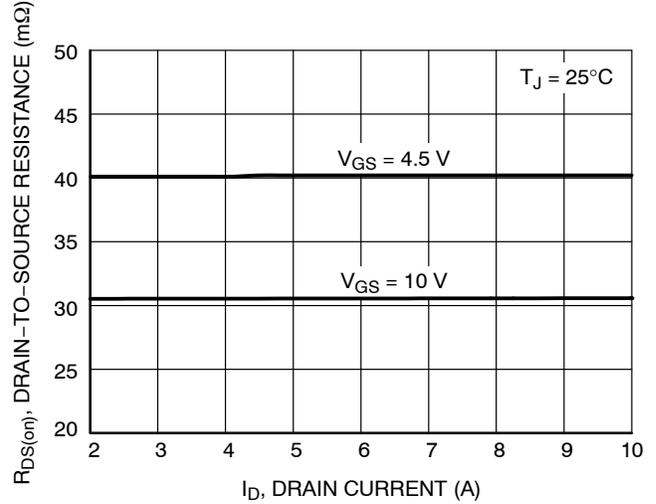


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

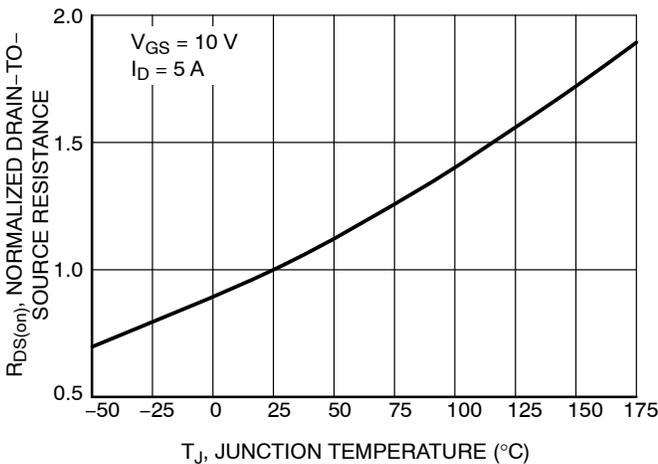


Figure 5. On-Resistance Variation with Temperature

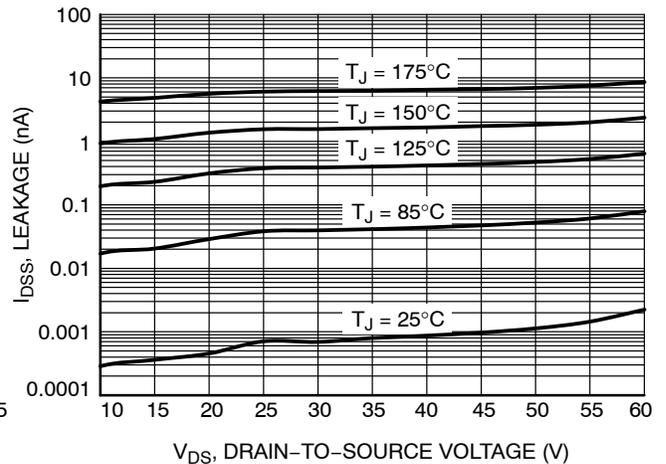


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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## TYPICAL CHARACTERISTICS

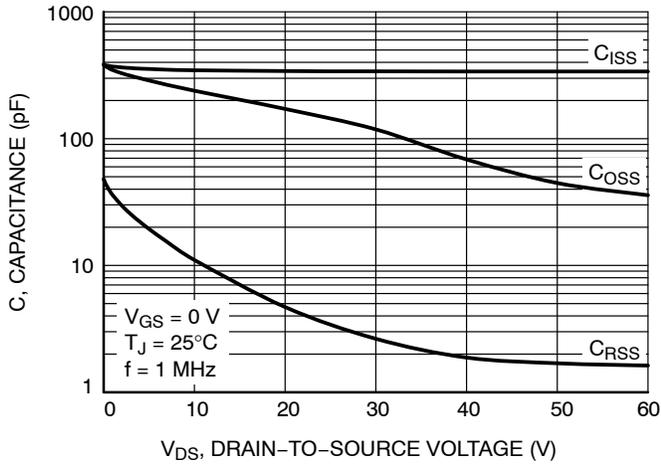


Figure 7. Capacitance Variation

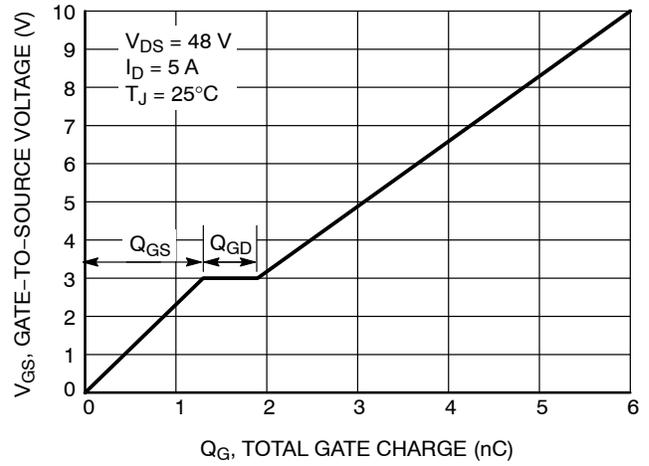


Figure 8. Gate-to-Source vs. Total Charge

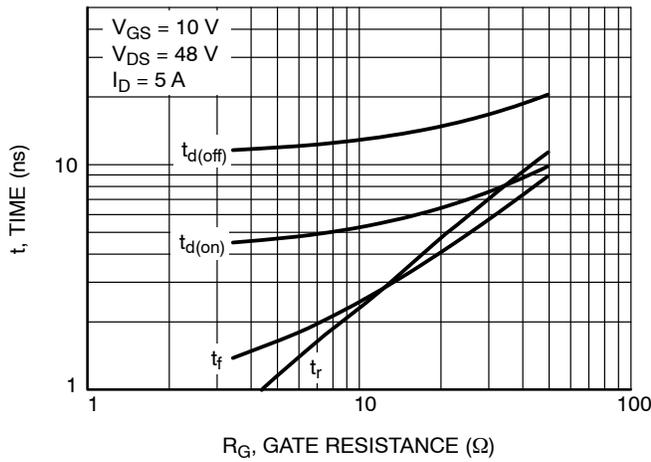


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

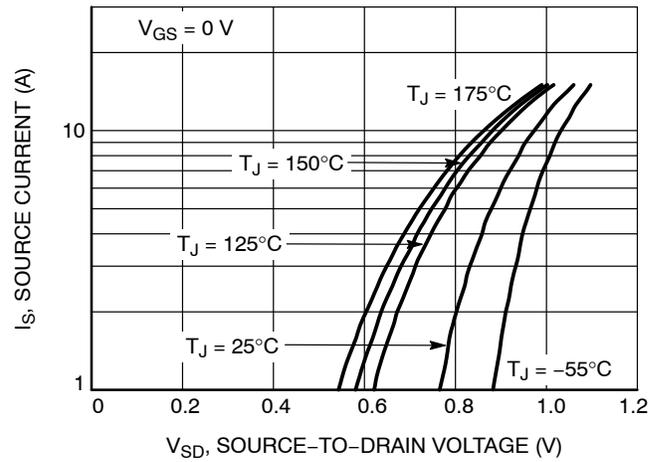


Figure 10. Diode Forward Voltage vs. Current

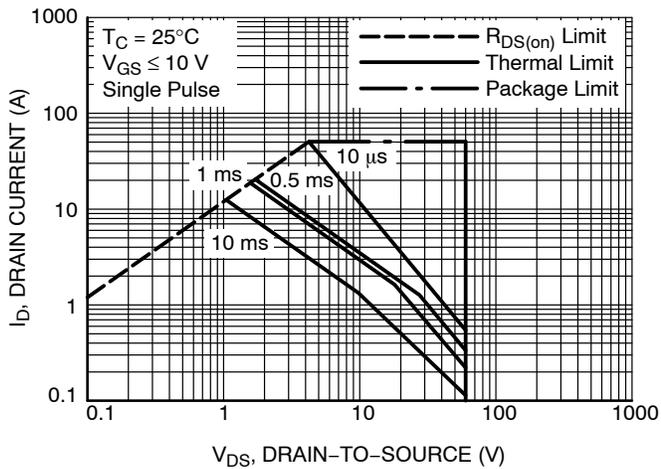


Figure 11. Safe Operating Area

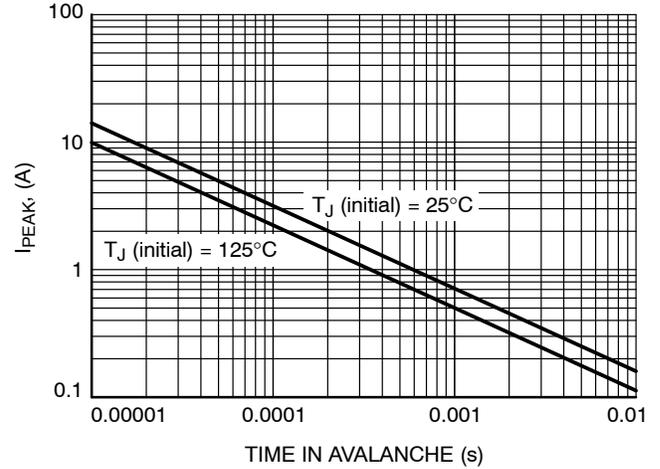


Figure 12.  $I_{PEAK}$  vs. Time in Avalanche

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## TYPICAL CHARACTERISTICS

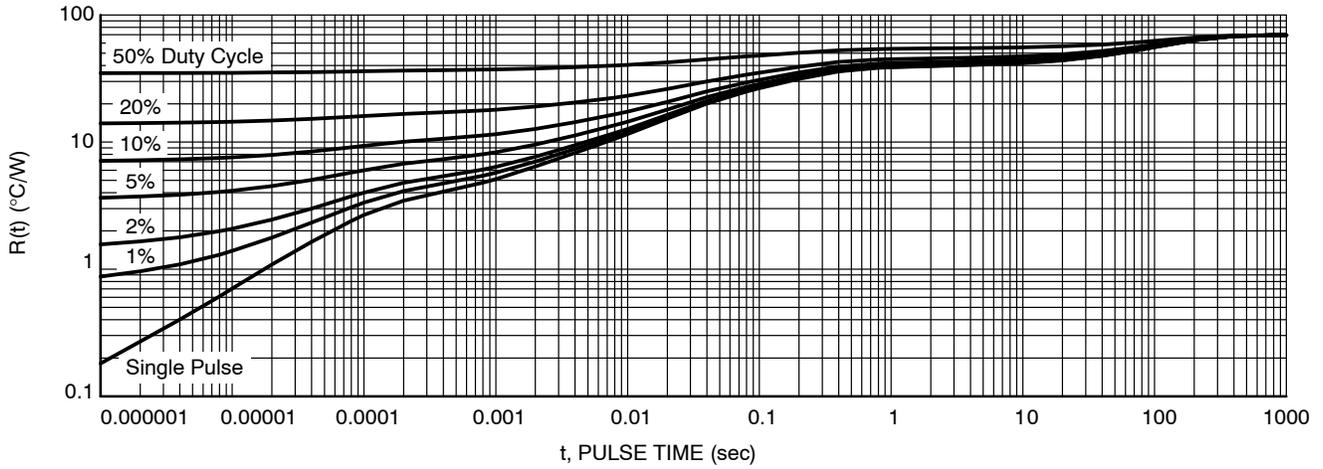


Figure 13. Transient Thermal Response Curve

### DEVICE ORDERING INFORMATION

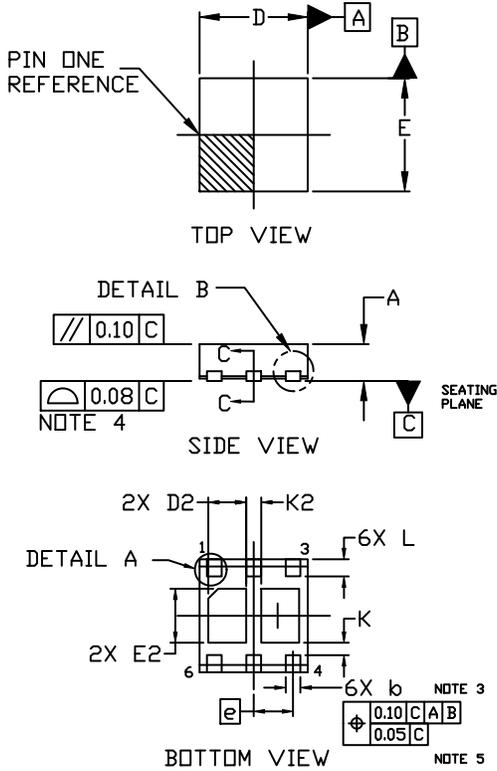
Device	Marking	Package	Shipping <sup>†</sup>
NVLJWD040N06CLTAG	040N	WDFNW6 (Pb-Free, Wettable Flanks)	3000 / Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

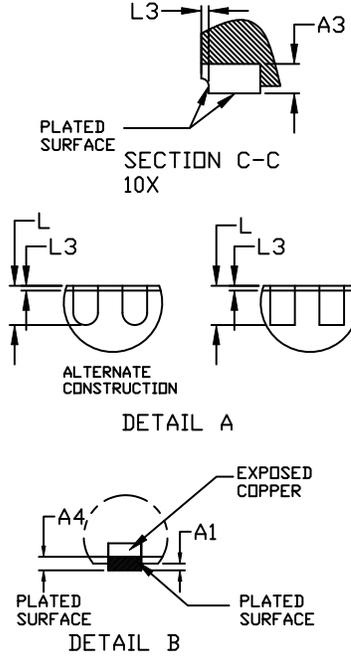
# NVLJWD040N06CL

## PACKAGE DIMENSIONS

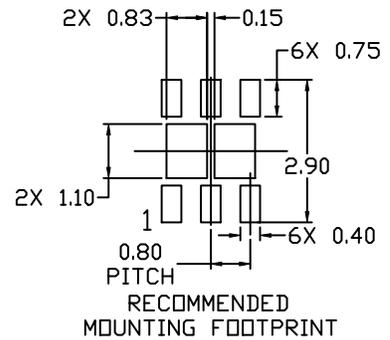
**WDFNW6 2.2x2.3, 0.8P**  
**CASE 515AS**  
**ISSUE O**



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
  2. CONTROLLING DIMENSION: MILLIMETERS
  3. DIMENSION *b* APPLIES TO PLATED TERMINALS AND IS MEASURED BETWEEN 0.15 AND 0.30MM FROM THE TERMINAL TIP.
  4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
  5. POSITIONAL TOLERANCE APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.



DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	0.00	---	0.05
A3	0.20 REF		
A4	0.10	---	---
b	0.25	0.30	0.35
D	2.10	2.20	2.30
D2	0.72	0.77	0.82
E	2.20	2.30	2.40
E2	1.05	1.10	1.15
e	0.80 BSC		
K	0.25 REF		
K2	0.30 REF		
L	0.30	0.35	0.40
L3	---	---	0.09



\* For additional information on our Pb-Free strategy and soldering details, please download the IN Semiconductor Soldering and Mounting Techniques Reference Manual, SLDERRH/D.

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