

# MOSFET – Power, N-Channel with Schottky Barrier Diode, Schottky Diode, $\mu$ Cool, WDFN 2X2 mm

**30 V, 4.6 A, 2.0 A**

## NTLJF4156N

### Features

- WDFN Package Provides Exposed Drain Pad for Excellent Thermal Conduction
- Co-Packaged MOSFET and Schottky For Easy Circuit Layout
- $R_{DS(on)}$  Rated at Low  $V_{GS(on)}$  Levels,  $V_{GS} = 1.5$  V
- Low Profile (<0.8 mm) for Easy Fit in Thin Environments
- Low  $V_F$  Schottky
- This is a Pb-Free Device

### Applications

- DC-DC Converters
- Li-Ion Battery Applications in Cell Phones, PDA's, Media Players
- Color Display and Camera Flash Regulators

### 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		$V_{GS}$	$\pm 8.0$	V	
Continuous Drain Current (Note 1)	Steady State	$T_J = 25$ °C	$I_D$	3.7	A
		$T_J = 85$ °C		2.7	
	$t \leq 5$ s	$T_J = 25$ °C		4.6	
Power Dissipation (Note 1)	Steady State	$T_J = 25$ °C	$P_D$	1.5	W
		$t \leq 5$ s		2.3	
Continuous Drain Current (Note 2)	Steady State	$T_J = 25$ °C	$I_D$	2.5	A
		$T_J = 85$ °C		1.8	
Power Dissipation (Note 2)	Steady State	$T_J = 25$ °C	$P_D$	0.71	
Pulsed Drain Current	$t_p = 10$ $\mu$ s	$I_{DM}$	20	A	
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-55 to 150	°C	
Source Current (Body Diode) (Note 2)		$I_S$	2.4	A	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	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.

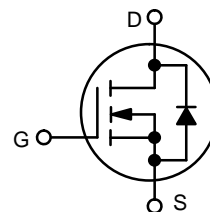
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
2. Surface Mounted on FR4 Board using the minimum recommended pad size of 30 mm<sup>2</sup>, 2 oz. Cu.

### MOSFET

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX (Note 1)
30 V	70 m $\Omega$ @ 4.5 V	4.6 A
	90 m $\Omega$ @ 2.5 V	
	125 m $\Omega$ @ 1.8 V	
	250 m $\Omega$ @ 1.5 V	

### SCHOTTKY DIODE

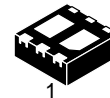
$V_R$ MAX	$V_F$ TYP	$I_F$ MAX
30 V	0.47 V	2.0 A



N-CHANNEL MOSFET



SCHOTTKY DIODE



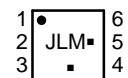
**WDFN6**  
**CASE 506AN**

JL = Specific Device Code  
M = Date Code

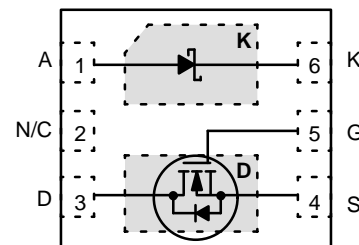
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### MARKING DIAGRAM



### PIN CONNECTIONS



### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

# NTLJF4156N

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

Parameter	Symbol	Value	Unit
Peak Repetitive Reverse Voltage	$V_{RRM}$	30	V
DC Blocking Voltage	$V_R$	30	V
Average Rectified Forward Current	$I_F$	2.0	A

## THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Ambient – Steady State (Note 3)	$R_{\theta JA}$	83	$^\circ\text{C/W}$
Junction-to-Ambient – $t \leq 5\text{ s}$ (Note 3)	$R_{\theta JA}$	54	
Junction-to-Ambient – Steady State Min Pad (Note 4)	$R_{\theta JA}$	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 of 30 mm<sup>2</sup>, 2 oz. Cu.

## MOSFET ELECTRICAL CHARACTERISTICS ( $T_J = 25\text{ }^\circ\text{C}$ 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 $^\circ\text{C}$		18.1		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$	$T_J = 25\text{ }^\circ\text{C}$		1.0	$\mu\text{A}$
			$T_J = 85\text{ }^\circ\text{C}$		10	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8.0\text{ V}$			100	nA

## ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	0.4	0.7	1.0	V
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			2.8		mV/ $^\circ\text{C}$
Drain-to-Source On-Resistance	$R_{DS(on)}$	$V_{GS} = 4.5, I_D = 2.0\text{ A}$		47	70	m $\Omega$
		$V_{GS} = 2.5, I_D = 2.0\text{ A}$		56	90	
		$V_{GS} = 1.8, I_D = 1.8\text{ A}$		88	125	
		$V_{GS} = 1.5, I_D = 1.5\text{ A}$		133	250	
Forward Transconductance	$g_{FS}$	$V_{DS} = 10\text{ V}, I_D = 2.0\text{ A}$		4.5		S

## CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 15\text{ V}$		427		pF
Output Capacitance	$C_{OSS}$			51		
Reverse Transfer Capacitance	$C_{RSS}$			32		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 2.0\text{ A}$		5.4	6.5	nC
Threshold Gate Charge	$Q_{G(TH)}$			0.5		
Gate-to-Source Charge	$Q_{GS}$			0.8		
Gate-to-Drain Charge	$Q_{GD}$			1.24		
Gate Resistance	$R_G$			3.7		$\Omega$

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.

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

# NTLJF4156N

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>SWITCHING CHARACTERISTICS</b> (Note 6)						
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DD} = 15\text{ V},$ $I_D = 2.0\text{ A}, R_G = 2.0\text{ }\Omega$		4.8		ns
Rise Time	$t_r$			9.2		
Turn-Off Delay Time	$t_{d(OFF)}$			14.2		
Fall Time	$t_f$			1.7		

## DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Recovery Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 2.0\text{ A}$	$T_J = 25\text{ }^\circ\text{C}$		0.78	1.2	V
			$T_J = 125\text{ }^\circ\text{C}$		0.62		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, d_{ISD}/d_t = 100\text{ A}/\mu\text{s},$ $I_S = 2.0\text{ A}$			10.5		ns
Charge Time	$t_a$				7.6		
Discharge Time	$t_b$				2.9		
Reverse Recovery Time	$Q_{RR}$				5.0		

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.

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

6. Switching characteristics are independent of operating junction temperatures.

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Instantaneous Forward Voltage	$V_F$	$I_F = 0.1\text{ A}$		0.34	0.39	V
		$I_F = 1.0\text{ A}$		0.47	0.53	
Maximum Instantaneous Reverse Current	$I_R$	$V_R = 30\text{ V}$		17	20	$\mu\text{A}$
		$V_R = 20\text{ V}$		3.0	8.0	
		$V_R = 10\text{ A}$		2.0	4.5	

## SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS ( $T_J = 85\text{ }^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Instantaneous Forward Voltage	$V_F$	$I_F = 0.1\text{ A}$		0.22	0.35	V
		$I_F = 1.0\text{ A}$		0.40	0.50	
Maximum Instantaneous Reverse Current	$I_R$	$V_R = 30\text{ V}$		0.22	2.5	mA
		$V_R = 20\text{ V}$		0.11	1.6	
		$V_R = 10\text{ V}$		0.06	1.2	

## SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS ( $T_J = 125\text{ }^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Instantaneous Forward Voltage	$V_F$	$I_F = 0.1\text{ A}$		0.2	0.29	V
		$I_F = 1.0\text{ A}$		0.4	0.47	
Maximum Instantaneous Reverse Current	$I_R$	$V_R = 30\text{ V}$		2.0	20	mA
		$V_R = 20\text{ V}$		1.1	10.9	
		$V_R = 10\text{ V}$		0.63	8.4	

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Capacitance	C	$V_R = 5.0\text{ V}, f = 1.0\text{ MHz}$		38		pF

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.

7. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).

8. Surface-mounted on FR4 board using the minimum recommended pad size of 30 mm<sup>2</sup>, 2 oz cu.

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

10. Switching characteristics are independent of operating junction temperatures.

# NTLJF4156N

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

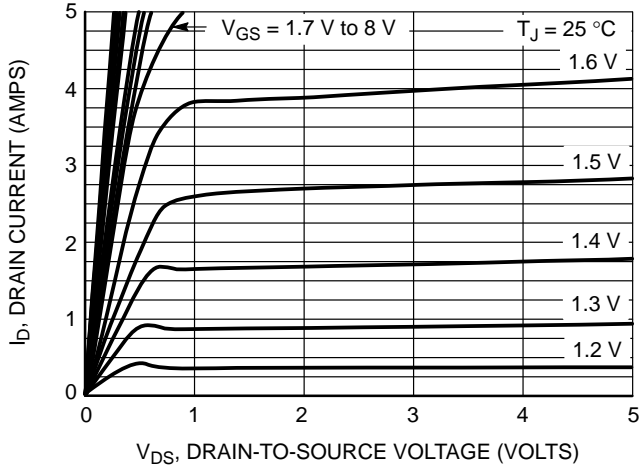


Figure 1. On-Region Characteristics

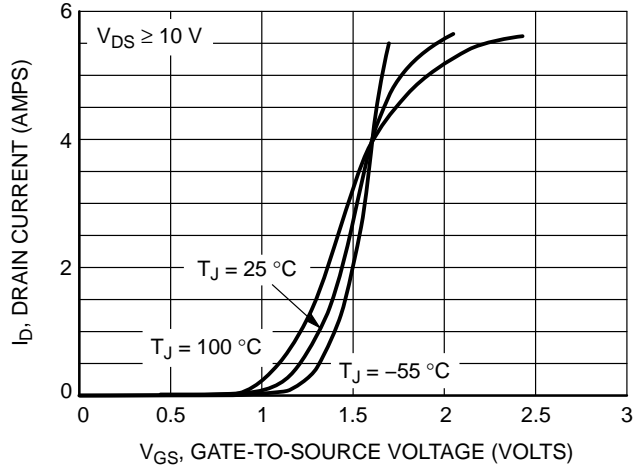


Figure 2. Transfer Characteristics

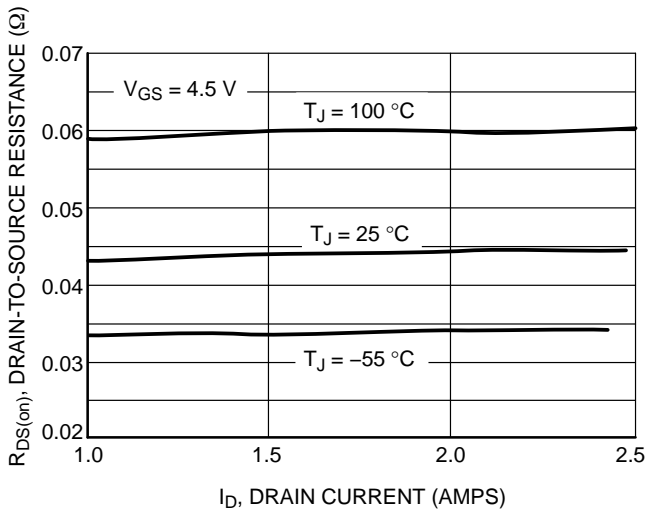


Figure 3. On-Resistance versus Drain Current



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

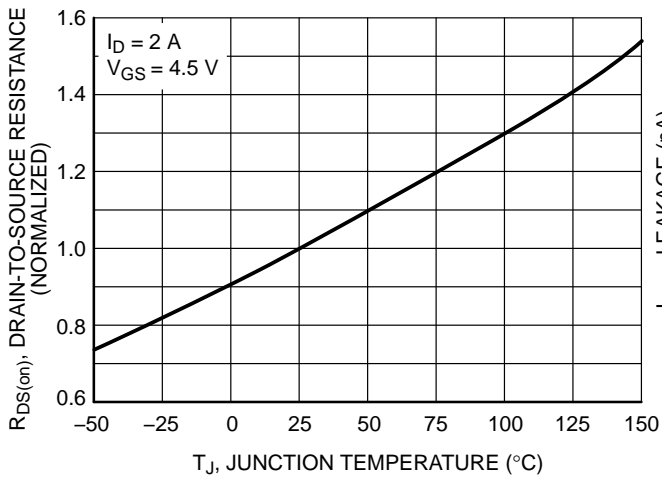


Figure 5. On-Resistance Variation with Temperature

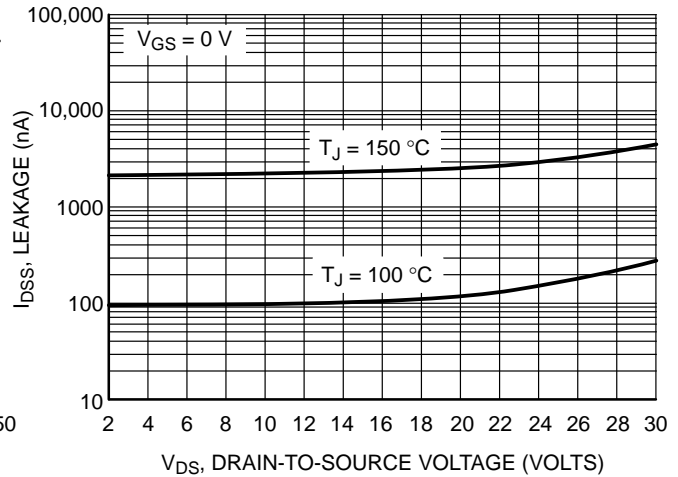


Figure 6. Drain-to-Source Leakage Current versus Voltage

# NTLJF4156N

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

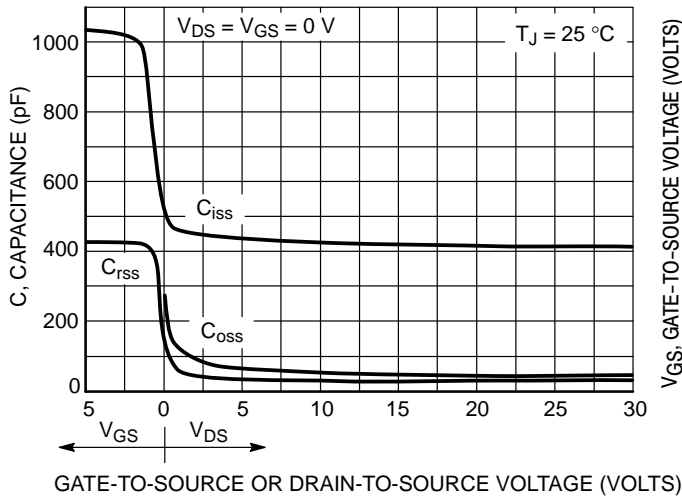


Figure 7. Capacitance Variation

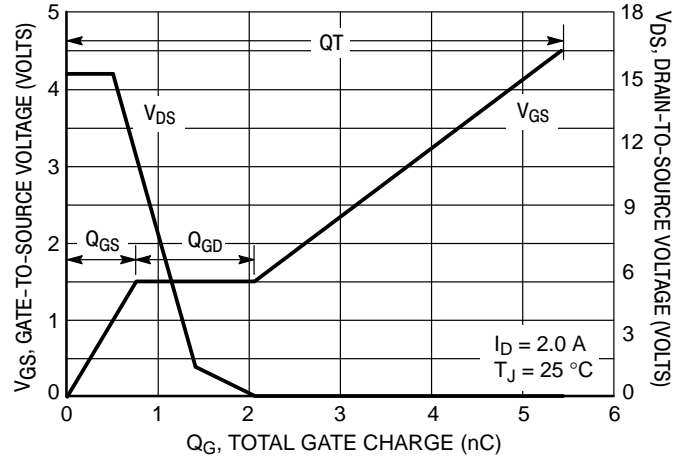


Figure 8. Gate-To-Source and Drain-To-Source Voltage versus Total Charge

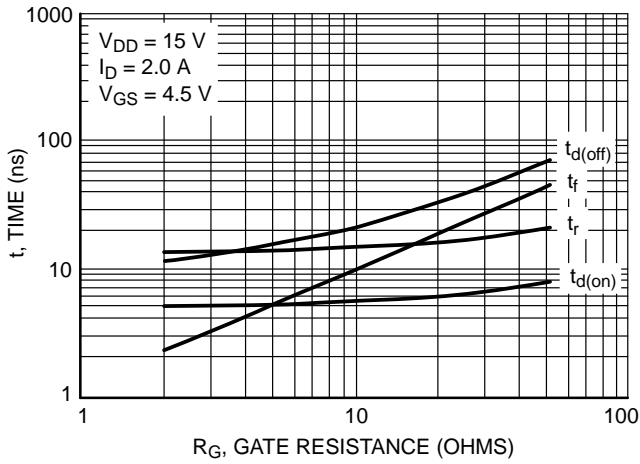


Figure 9. Resistive Switching Time Variation versus Gate Resistance

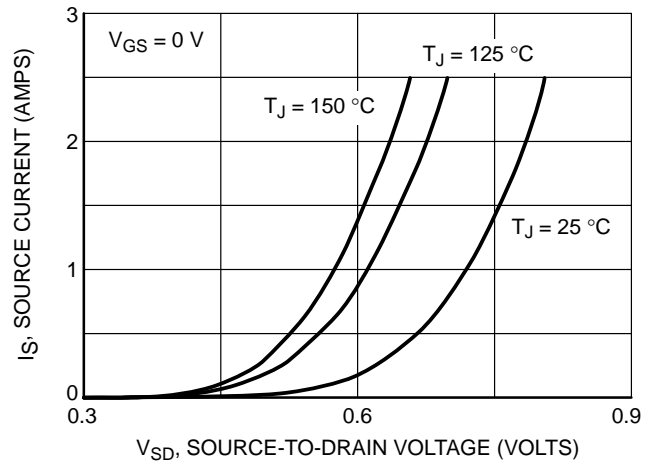


Figure 10. Diode Forward Voltage versus Current

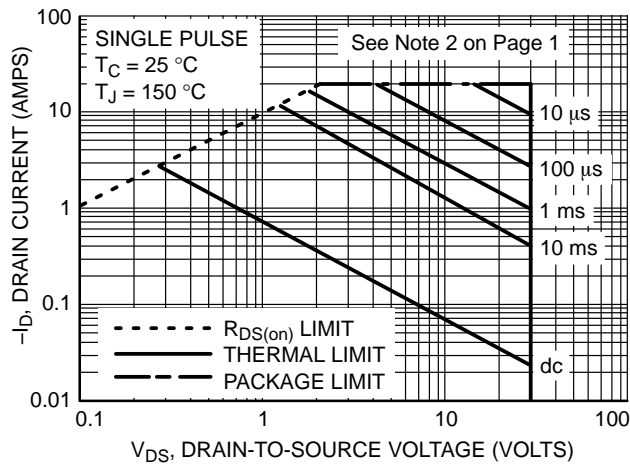


Figure 11. Maximum Rated Forward Biased Safe Operating Area

# NTLJF4156N

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

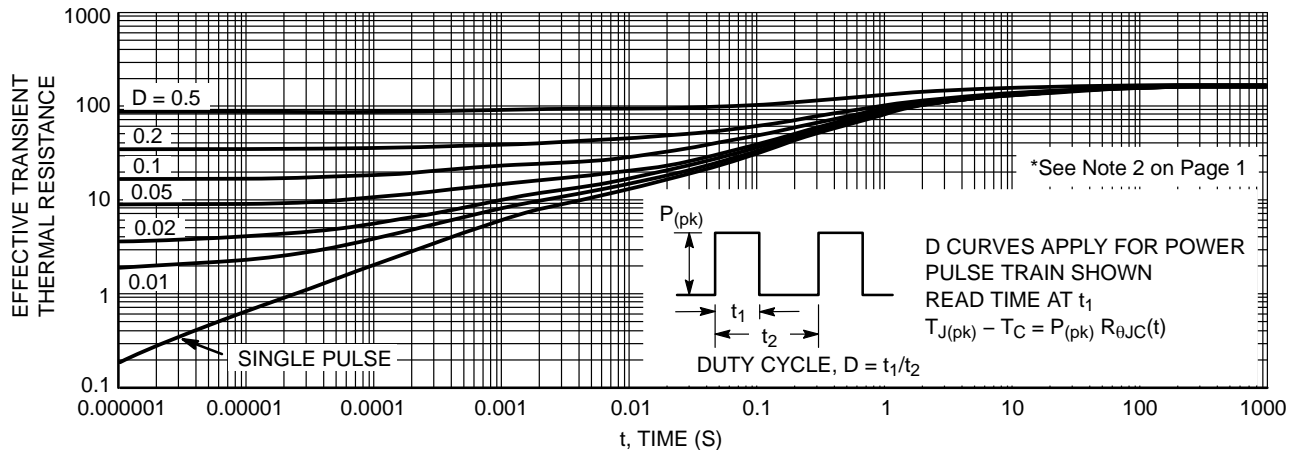


Figure 12. Thermal Response

# NTLJF4156N

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

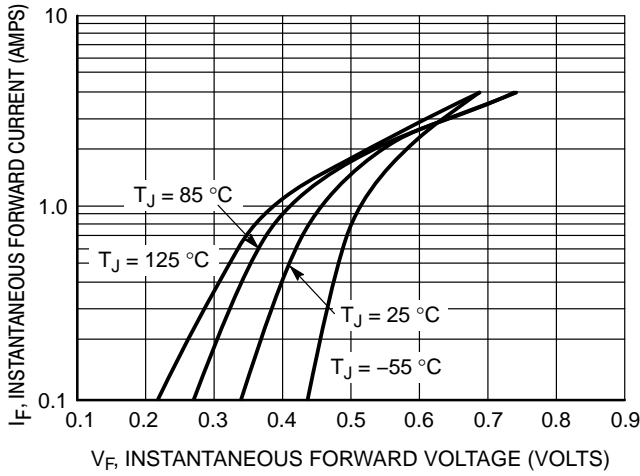


Figure 13. Typical Forward Voltage

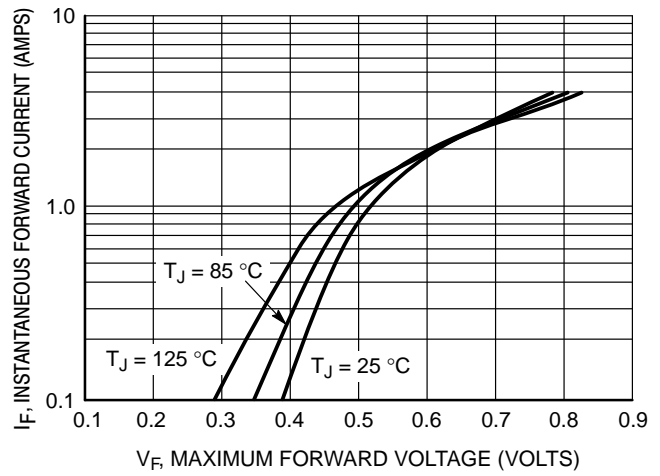


Figure 14. Maximum Forward Voltage

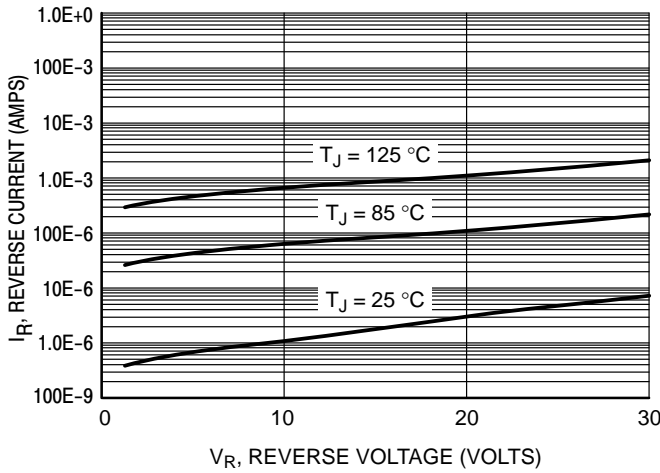


Figure 15. Typical Reverse Current

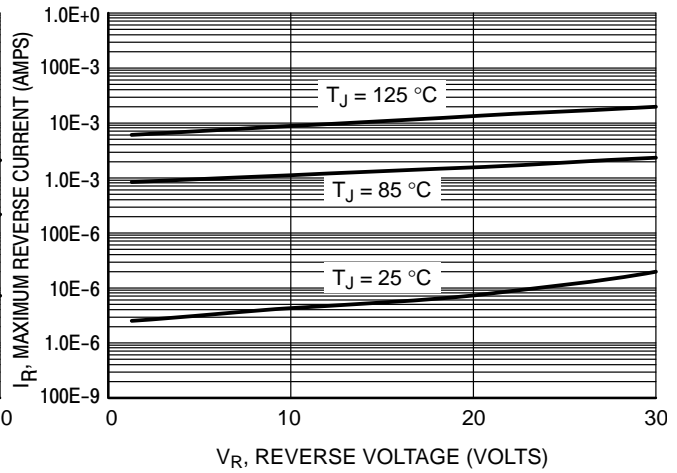


Figure 16. Maximum Reverse Current

### ORDERING INFORMATION

Device	Package	Shipping†
NTLJF4156NT1G	WDFN6 (Pb-Free)	3000 / Tape & Reel
NTLJF4156NTAG	WDFN6 (Pb-Free)	3000 / Tape & Reel

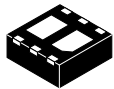
† For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).

# NTLJF4156N

## REVISION HISTORY

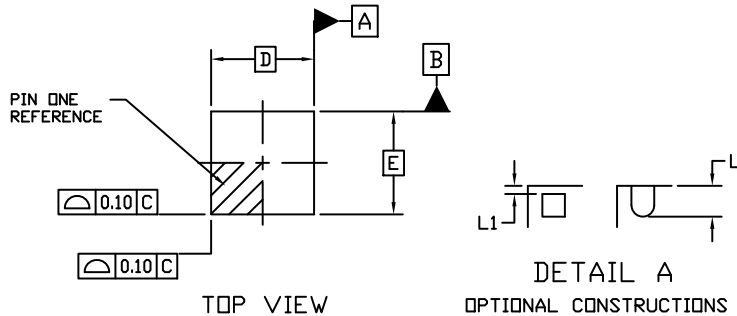
Revision	Description of Changes	Date
5	Rebranded the document to <b>onsemi</b> format.	2/6/20026

This document has undergone updates prior to the inclusion of this revision history table. The changes tracked here only reflect updates made on the noted approval dates.



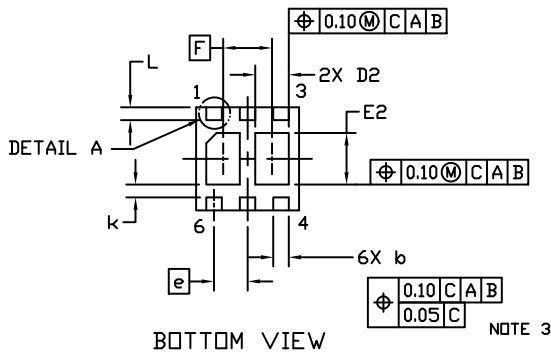
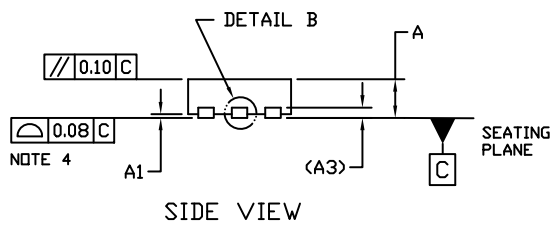
**WDFN6 2x2, 0.65P**  
**CASE 506AN**  
**ISSUE H**

DATE 25 JAN 2022



**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 0.30 MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.



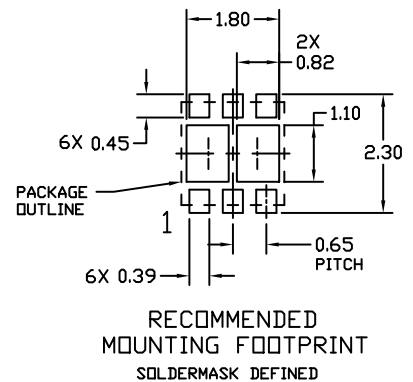
DIM	MILLIMETERS	
	MIN.	MAX.
A	0.70	0.80
A1	0.00	0.05
A3	0.20 REF	
<i>b</i>	0.25	0.35
D	2.00 BSC	
D2	0.57	0.77
E	2.00 BSC	
E2	0.90	1.10
<i>e</i>	0.65 BSC	
F	0.95 BSC	
<i>k</i>	0.25 REF	
L	0.20	0.30
L1	---	0.10

**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. Some products may not follow the Generic Marking.



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<b>DESCRIPTION:</b>	<b>WDFN6 2x2, 0.65P</b>	<b>PAGE 1 OF 1</b>

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