

NTLJF4156N

Power MOSFET and Schottky Diode

30 V, 4.6 A, μ Cool™ N-Channel, with
2.0 A Schottky Barrier Diode, 2x2 mm
WDFN Package

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

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V_{DSS}	30	V
Gate-to-Source Voltage			V_{GS}	± 8.0	V
Continuous Drain Current (Note 1)	Steady State	$T_J = 25^{\circ}\text{C}$	I_D	3.7	A
		$T_J = 85^{\circ}\text{C}$		2.7	
	$t \leq 5\text{ s}$	$T_J = 25^{\circ}\text{C}$		4.6	
Power Dissipation (Note 1)	Steady State	$T_J = 25^{\circ}\text{C}$	P_D	1.5	W
	$t \leq 5\text{ s}$			2.3	
Continuous Drain Current (Note 2)	Steady State	$T_J = 25^{\circ}\text{C}$	I_D	2.5	A
		$T_J = 85^{\circ}\text{C}$		1.8	
Power Dissipation (Note 2)			$T_J = 25^{\circ}\text{C}$	P_D	
Pulsed Drain Current	$t_p = 10\text{ }\mu\text{s}$		I_{DM}	20	A
Operating Junction and Storage Temperature			T_J, T_{STG}	-55 to 150	$^{\circ}\text{C}$
Source Current (Body Diode) (Note 2)			I_S	2.4	A
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T_L	260	$^{\circ}\text{C}$

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, 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 mm², 2 oz. Cu.



ON Semiconductor®

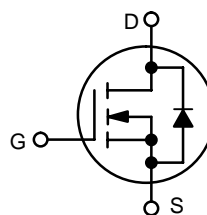
<http://onsemi.com>

MOSFET

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

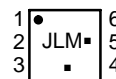
JL = Specific Device Code

M = Date Code

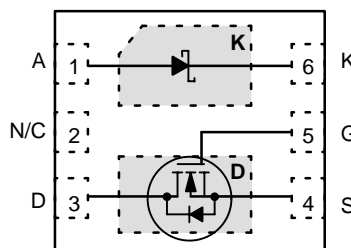
■ = Pb-Free Package

(Note: Microdot may be in either location)

MARKING DIAGRAM



PIN CONNECTIONS



(Top View)

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 ($T_J = 25^\circ\text{C}$ 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 – $t \leq 5$ s (Note 3)	$R_{\theta JA}$	54	
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 of 30 mm², 2 oz. Cu.

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
-----------	--------	-----------------	-----	-----	-----	------

OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0$ V, $I_D = 250$ μA	30			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = 250$ μA , Ref to 25°C		18.1		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 24$ V, $V_{GS} = 0$ V	$T_J = 25^\circ\text{C}$		1.0	μA
			$T_J = 85^\circ\text{C}$		10	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0$ V, $V_{GS} = \pm 8.0$ V			100	nA

ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}$, $I_D = 250$ μA	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	$R_{DS(on)}$	$V_{GS} = 4.5$, $I_D = 2.0$ A		47	70	m Ω
		$V_{GS} = 2.5$, $I_D = 2.0$ A		56	90	
		$V_{GS} = 1.8$, $I_D = 1.8$ A		88	125	
		$V_{GS} = 1.5$, $I_D = 1.5$ A		133	250	
Forward Transconductance	g_{FS}	$V_{DS} = 10$ V, $I_D = 2.0$ A		4.5		S

CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{GS} = 0$ V, $f = 1.0$ MHz, $V_{DS} = 15$ V		427		pF
Output Capacitance	C_{OSS}			51		
Reverse Transfer Capacitance	C_{RSS}			32		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5$ V, $V_{DS} = 15$ V, $I_D = 2.0$ 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		Ω

5. Pulse Test: Pulse Width ≤ 300 μs , Duty Cycle $\leq 2\%$.

6. Switching characteristics are independent of operating junction temperatures.

NTLJF4156N

MOSFET ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS (Note 6)						
Turn-On Delay Time	t _{d(ON)}	V _{GS} = 4.5 V, V _{DD} = 15 V, I _D = 2.0 A, R _G = 2.0 Ω		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 V, I _S = 2.0 A	T _J = 25°C		0.78	1.2	V
			T _J = 125°C		0.62		
Reverse Recovery Time	t _{RR}	V _{GS} = 0 V, dI _{SD} /dI _f = 100 A/μs, I _S = 2.0 A			10.5		ns
Charge Time	t _a				7.6		
Discharge Time	t _b				2.9		
Reverse Recovery Time	Q _{RR}				5.0		nC

5. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

6. Switching characteristics are independent of operating junction temperatures.

SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Instantaneous Forward Voltage	V _F	I _F = 0.1 A		0.34	0.39	V
		I _F = 1.0 A		0.47	0.53	
Maximum Instantaneous Reverse Current	I _R	V _R = 30 V		17	20	μA
		V _R = 20 V		3.0	8.0	
		V _R = 10 A		2.0	4.5	

SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS (T_J = 85°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Instantaneous Forward Voltage	V _F	I _F = 0.1 A		0.22	0.35	V
		I _F = 1.0 A		0.40	0.50	
Maximum Instantaneous Reverse Current	I _R	V _R = 30 V		0.22	2.5	mA
		V _R = 20 V		0.11	1.6	
		V _R = 10 V		0.06	1.2	

SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS (T_J = 125°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Instantaneous Forward Voltage	V _F	I _F = 0.1 A		0.2	0.29	V
		I _F = 1.0 A		0.4	0.47	
Maximum Instantaneous Reverse Current	I _R	V _R = 30 V		2.0	20	mA
		V _R = 20 V		1.1	10.9	
		V _R = 10 V		0.63	8.4	

SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Capacitance	C	V _R = 5.0 V, f = 1.0 MHz		38		pF

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 mm², 2 oz cu.

9. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

10. Switching characteristics are independent of operating junction temperatures.

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

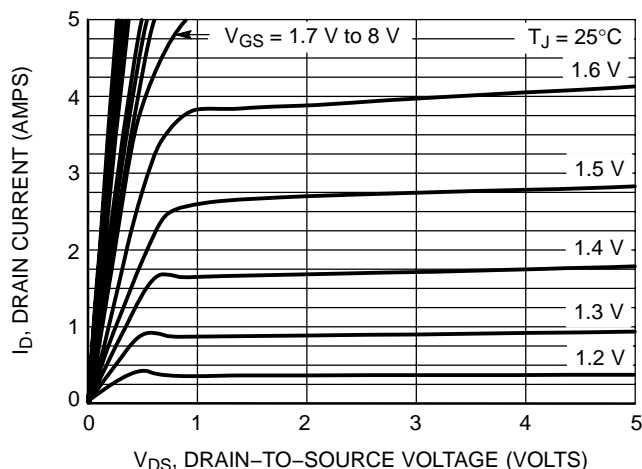


Figure 1. On-Region Characteristics

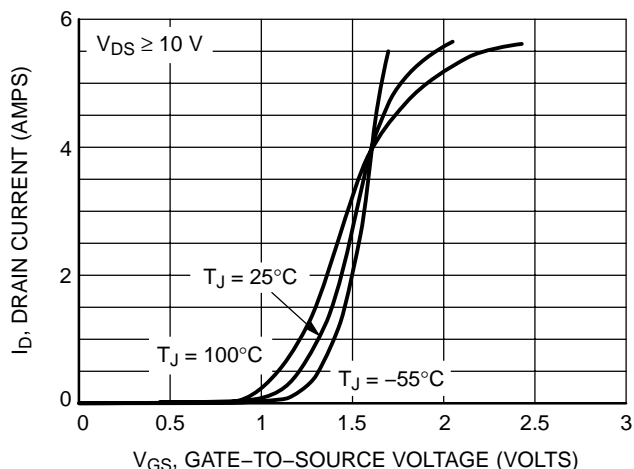


Figure 2. Transfer Characteristics

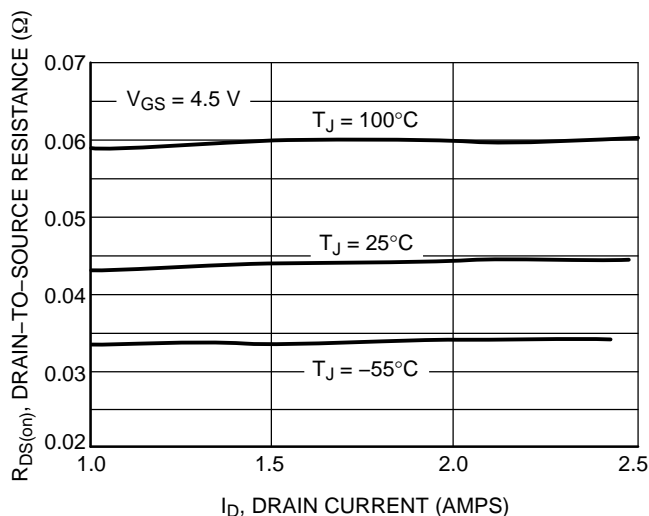


Figure 3. On-Resistance versus Drain Current

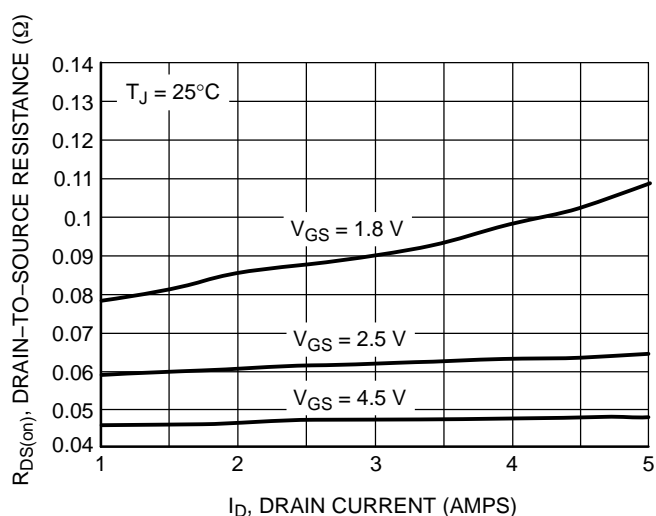


Figure 4. On-Resistance versus Drain Current and Gate Voltage

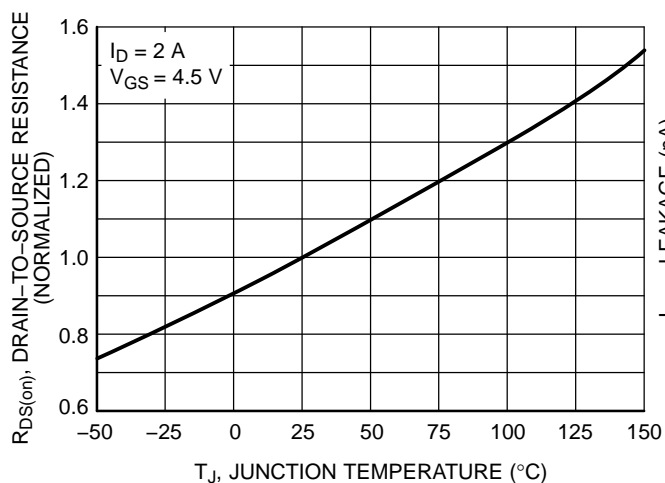


Figure 5. On-Resistance Variation with Temperature

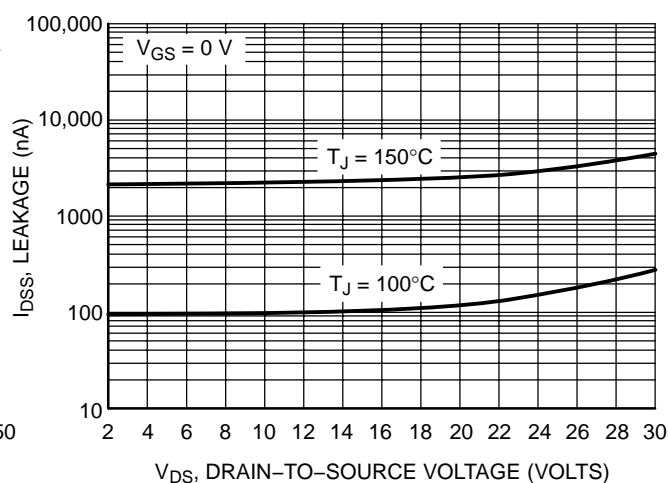


Figure 6. Drain-to-Source Leakage Current versus Voltage

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

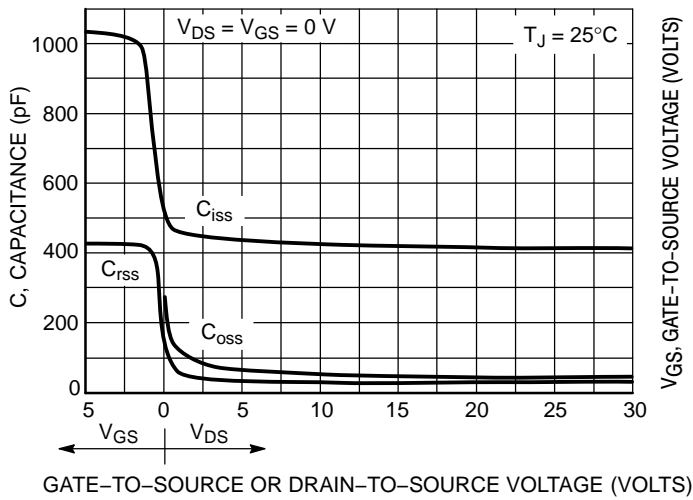


Figure 7. Capacitance Variation

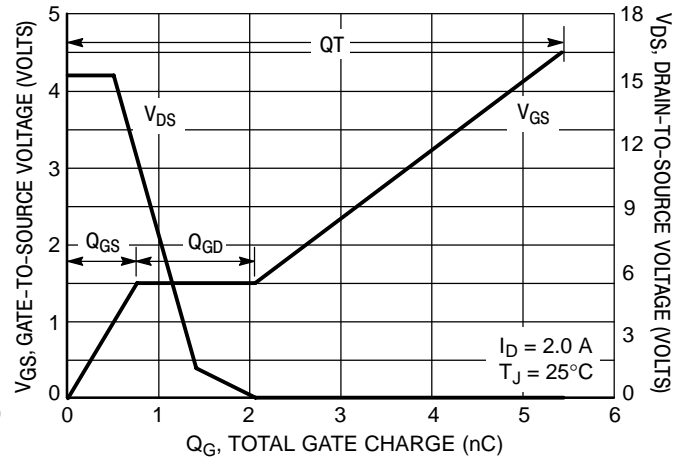


Figure 8. Gate-To-Source and Drain-To-Source Voltage versus Total Charge

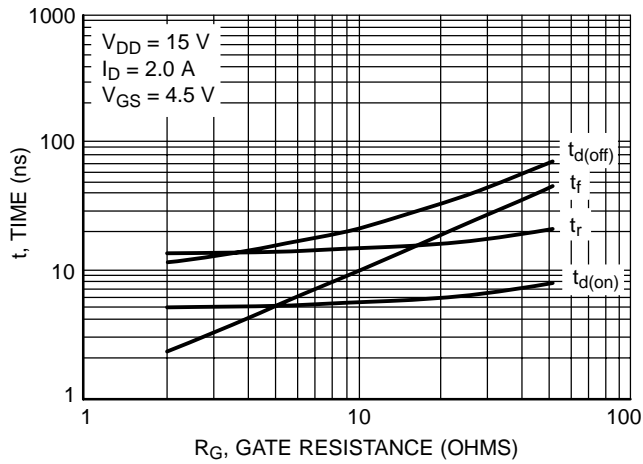


Figure 9. Resistive Switching Time Variation versus Gate Resistance

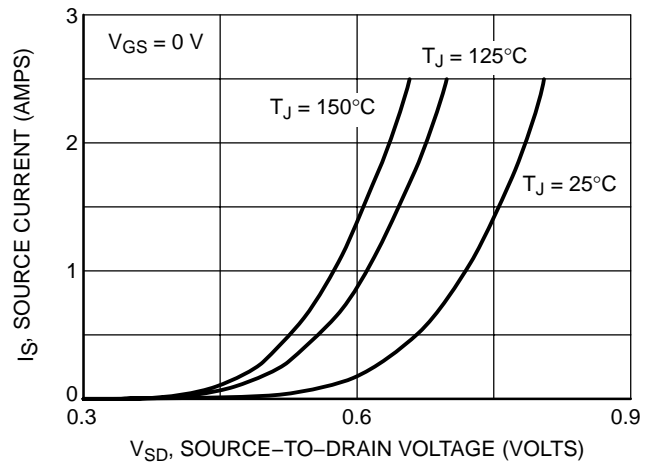


Figure 10. Diode Forward Voltage versus Current

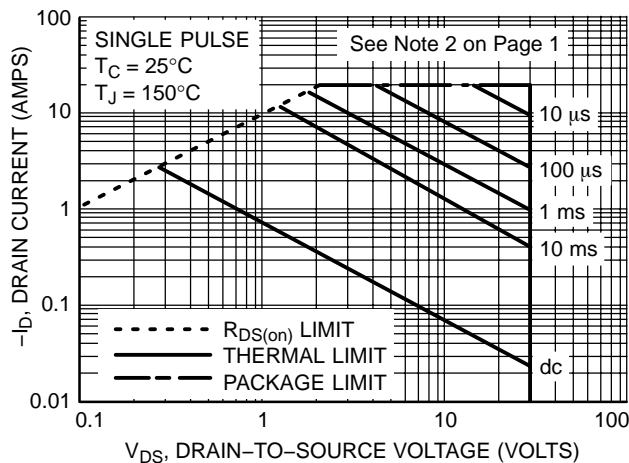


Figure 11. Maximum Rated Forward Biased Safe Operating Area

NTLJF4156N

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

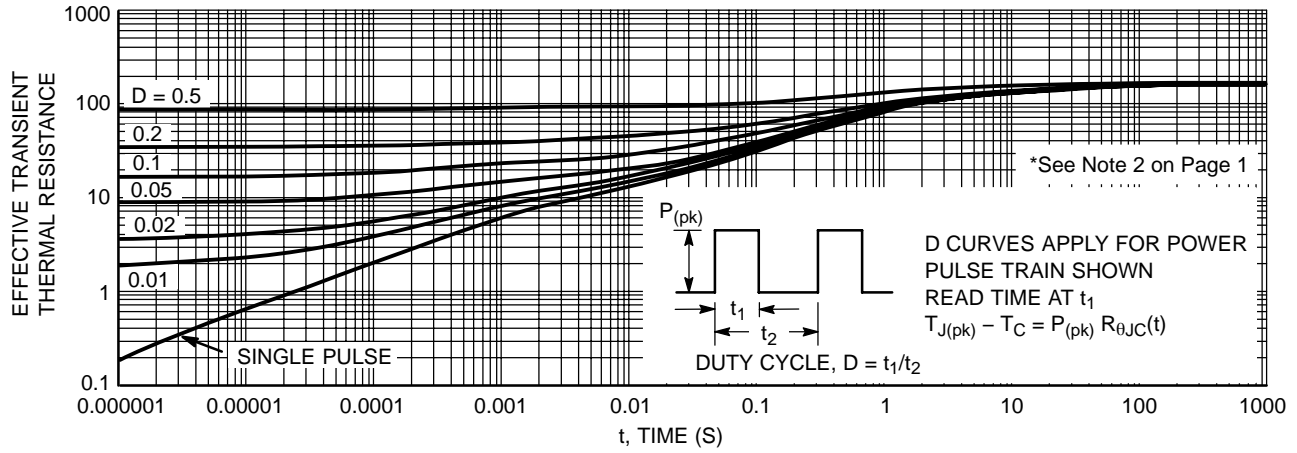


Figure 12. Thermal Response

NTLJF4156N

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

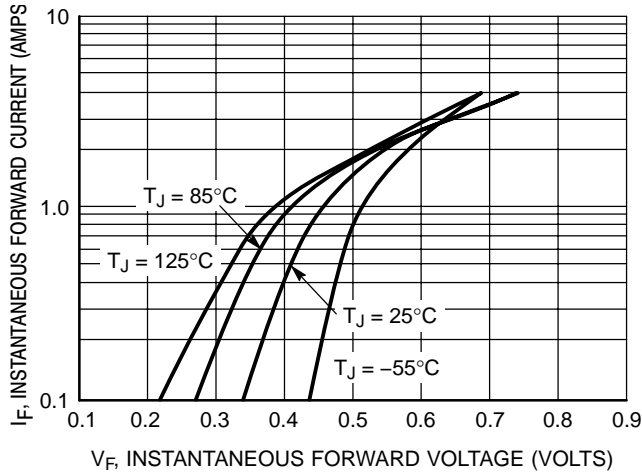


Figure 13. Typical Forward Voltage

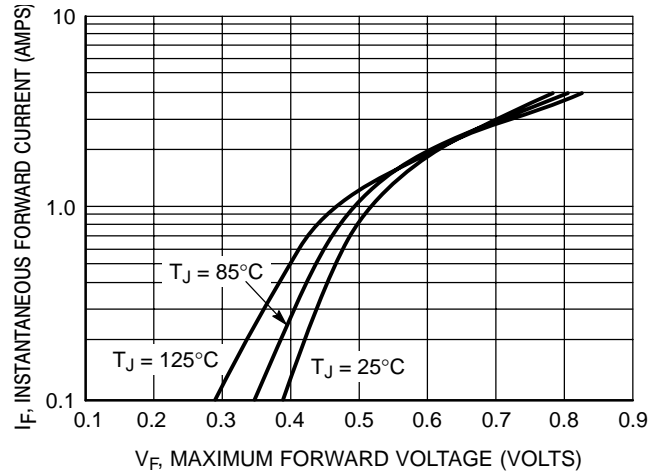


Figure 14. Maximum Forward Voltage

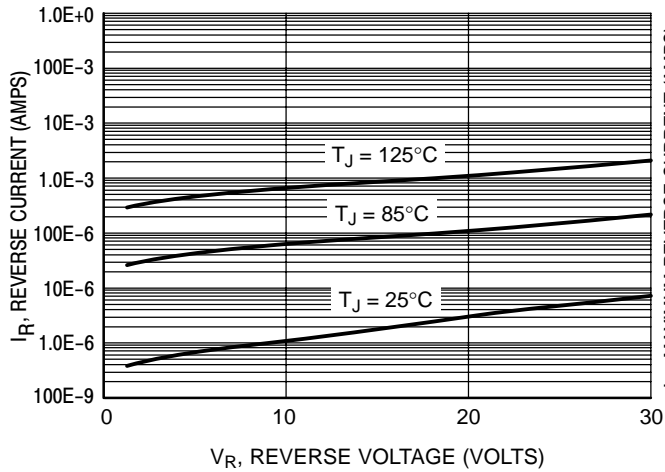


Figure 15. Typical Reverse Current

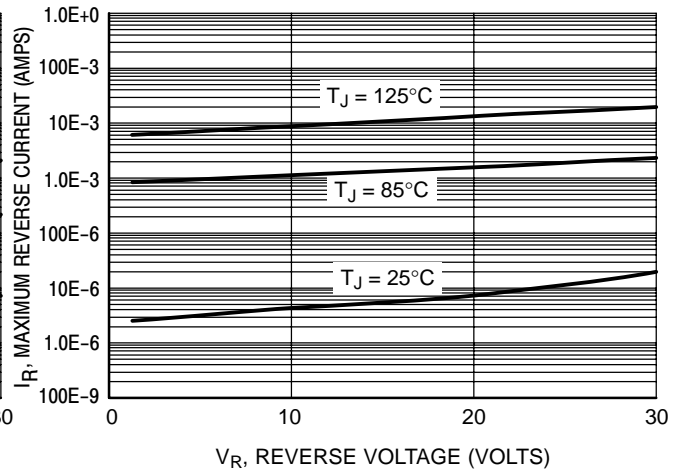


Figure 16. Maximum Reverse Current

ORDERING INFORMATION

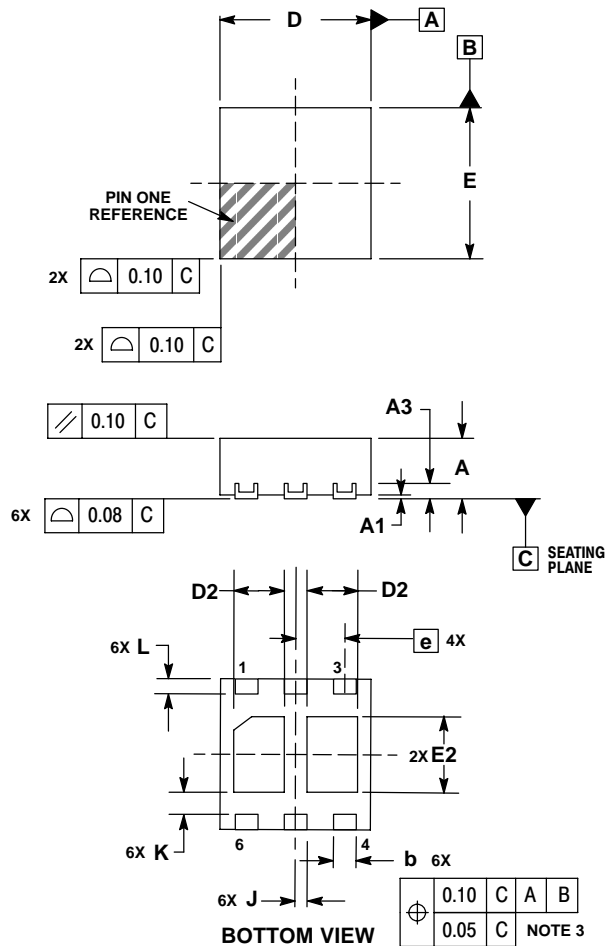
Device	Package	Shipping [†]
NTLJF4156NT1G	WDFN6 (Pb-Free)	3000 / Tape & Reel

[†]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

PACKAGE DIMENSIONS

WDFN6, 2x2
CASE 506AN-01
ISSUE B

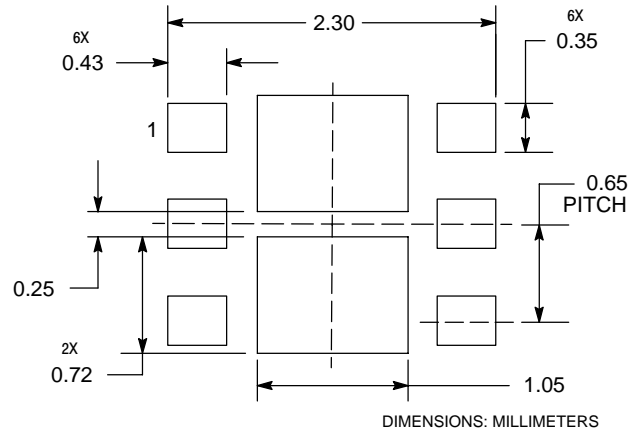


NOTES:

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.


DIM	MILLIMETERS	
	MIN	MAX
A	0.70	0.80
A1	0.00	0.05
A3	0.20 REF	
b	0.25	0.35
D	2.00 BSC	
D2	0.57	0.77
E	2.00 BSC	
E2	0.90	1.10
e	0.65 BSC	
K	0.25	REF
L	0.20	0.30
J	0.15 REF	

SOLDERMASK DEFINED MOUNTING FOOTPRINT*



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

µCool is a trademark of Semiconductor Components Industries, LLC (SCILLC).

ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 61312, Phoenix, Arizona 85082-1312 USA
Phone: 480-829-7710 or 800-344-3860 Toll Free USA/Canada
Fax: 480-829-7709 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada

Japan: ON Semiconductor, Japan Customer Focus Center
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051
Phone: 81-3-5773-3850

ON Semiconductor Website: <http://onsemi.com>

Order Literature: <http://www.onsemi.com/litorder>

For additional information, please contact your local Sales Representative.

NTLJF4156N/D