

# NTLJF3117P

## MOSFET – Power, P-Channel, Schottky Diode, Schottky Barrier Diode, μCool 2x2 mm -20 V, -4.1 A, 2.0

### Features

- FETKY™ Configuration with MOSFET plus Low Vf Schottky Diode
- μCOOL™ Package Provides Exposed Drain Pad for Excellent Thermal Conduction
- 2x2 mm Footprint Same as SC–88 Package Design
- Independent Pinout Provides Circuit Design Flexibility
- Low Profile (< 0.8 mm) for Easy Fit in Thin Environment
- High Current Schottky Diode: 2 A Current Rating
- This is a Pb–Free Device

### Applications

- Optimized for Portable Applications like Cell Phones, Digital Cameras, Media Players, etc.
- DC–DC Buck Circuit
- Li–Ion Battery Applications
- Color Display and Camera Flash Regulators

### MAXIMUM RATINGS (T<sub>J</sub> = 25°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>	-3.3	A
		T <sub>A</sub> = 85°C		-2.4	
	t ≤ 5 s	T <sub>A</sub> = 25°C		-4.1	
Power Dissipation (Note 1)	Steady State	T <sub>A</sub> = 25°C	P <sub>D</sub>	1.5	W
				t ≤ 5 s	
Continuous Drain Current (Note 2)	Steady State	T <sub>A</sub> = 25°C	I <sub>D</sub>	-2.3	A
		T <sub>A</sub> = 85°C		-1.6	
Power Dissipation (Note 2)	Steady State	T <sub>A</sub> = 25°C	P <sub>D</sub>	0.71	W
Pulsed Drain Current	t <sub>p</sub> = 10 μs	I <sub>DM</sub>	-20	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>	-1.9	A	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		T <sub>L</sub>	260	°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 [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.



ON Semiconductor®

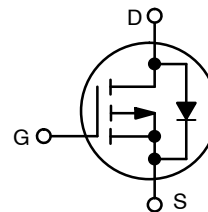
<http://onsemi.com>

### MOSFET

V <sub>(BR)DSS</sub>	R <sub>DS(on)</sub> MAX	I <sub>D</sub> MAX (Note 1)
-20 V	100 mΩ @ -4.5 V	-4.1 A
	135 mΩ @ -2.5 V	
	200 mΩ @ -1.8 V	

### SCHOTTKY DIODE

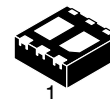
V <sub>R</sub> MAX	V <sub>F</sub> TYP	I <sub>F</sub> MAX
30 V	0.47 V	2.0 A



P-CHANNEL MOSFET



SCHOTTKY DIODE



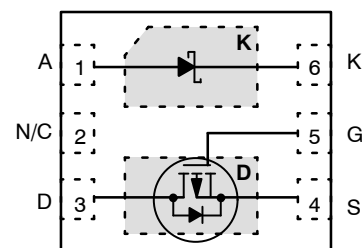
WDFN6  
CASE 506AN

### MARKING DIAGRAM



JH = Specific Device Code  
M = Date Code  
▪ = Pb–Free Package  
(Note: Microdot may be in either location)

### PIN CONNECTIONS



(Top View)

### ORDERING INFORMATION

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

# NTLJF3117P

## 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	$^\circ\text{C}/\text{W}$
Junction-to-Ambient – $t \leq 5$ s (Note 3)	$R_{\theta JA}$	54	
Junction-to-Ambient – Steady State Min Pad (Note 4)	$R_{\theta JA}$	177	

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 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
-----------	--------	-----------------	-----	-----	-----	------

### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0$ 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 $25^\circ\text{C}$		9.95		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -16$ V, $V_{GS} = 0$ V	$T_J = 25^\circ\text{C}$		-1.0	$\mu\text{A}$
			$T_J = 85^\circ\text{C}$		-10	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0$ V, $V_{GS} = \pm 8.0$ V			$\pm 100$	nA

### ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}$ , $I_D = -250$ $\mu\text{A}$	-0.4	-0.7	-1.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			2.44		mV/ $^\circ\text{C}$
Drain-to-Source On-Resistance	$R_{DS(on)}$	$V_{GS} = -4.5$ V, $I_D = -2.0$ A		75	100	m $\Omega$
		$V_{GS} = -2.5$ V, $I_D = -2.0$ A		101	135	
		$V_{GS} = -1.8$ V, $I_D = -1.6$ A		150	200	
Forward Transconductance	$g_{FS}$	$V_{DS} = -5.0$ V, $I_D = -2.0$ A		3.1		S

### CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0$ V, $f = 1.0$ MHz, $V_{DS} = -10$ V		531		pF
Output Capacitance	$C_{OSS}$			91		
Reverse Transfer Capacitance	$C_{RSS}$			56		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -4.5$ V, $V_{DS} = -10$ V, $I_D = -2.0$ A		5.5	6.2	nC
Threshold Gate Charge	$Q_{G(TH)}$			0.7		
Gate-to-Source Charge	$Q_{GS}$			1.0		
Gate-to-Drain Charge	$Q_{GD}$			1.4		
Gate Resistance	$R_G$			8.8		

### SWITCHING CHARACTERISTICS (Note 6)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -4.5$ V, $V_{DD} = -5.0$ V, $I_D = -1.0$ A, $R_G = 6.0$ $\Omega$		5.2		ns
Rise Time	$t_r$			13.2		
Turn-Off Delay Time	$t_{d(OFF)}$			13.7		
Fall Time	$t_f$			19.1		

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

6. Switching characteristics are independent of operating junction temperatures.

# NTLJF3117P

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>SWITCHING CHARACTERISTICS</b> (Note 6)						
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -4.5\text{ V}, V_{DD} = -10\text{ V},$ $I_D = -2.0\text{ A}, R_G = 2.0\ \Omega$		5.5		ns
Rise Time	$t_r$			15		
Turn-Off Delay Time	$t_{d(OFF)}$			19.8		
Fall Time	$t_f$			21.6		

## DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Recovery Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = -1.0\text{ A}$	$T_J = 25^\circ\text{C}$		-0.75	-1.0	V
			$T_J = 125^\circ\text{C}$		-0.64		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, d_{ISD}/d_t = 100\text{ A}/\mu\text{s},$ $I_S = -1.0\text{ A}$			16.2		ns
Charge Time	$t_a$				10.6		
Discharge Time	$t_b$				5.6		
Reverse Recovery Time	$Q_{RR}$				5.7		

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

6. Switching characteristics are independent of operating junction temperatures.

## SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ 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	
		$V_R = 10\text{ V}$		2.0	4.5	

## SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS ( $T_J = 85^\circ\text{C}$ 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 ( $T_J = 125^\circ\text{C}$ 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 ( $T_J = 25^\circ\text{C}$ 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

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  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

10. Switching characteristics are independent of operating junction temperatures.

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

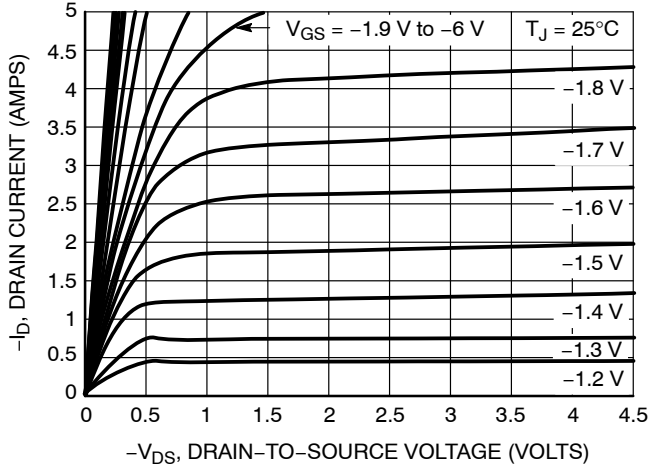


Figure 1. On-Region Characteristics

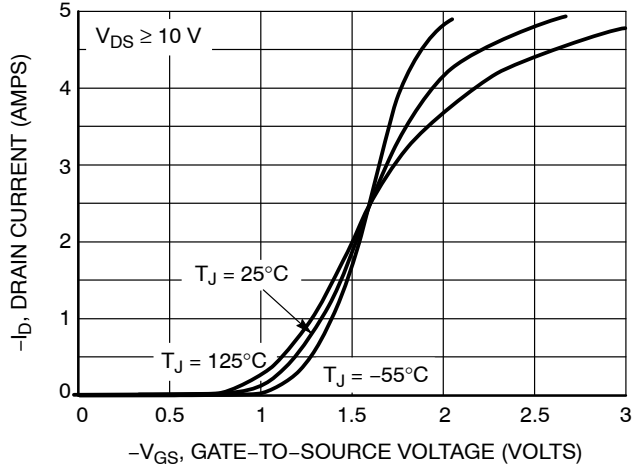


Figure 2. Transfer Characteristics

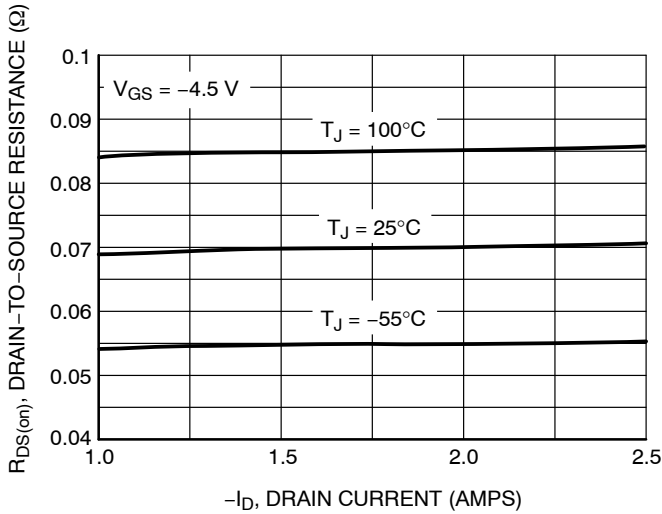


Figure 3. On-Resistance versus Drain Current

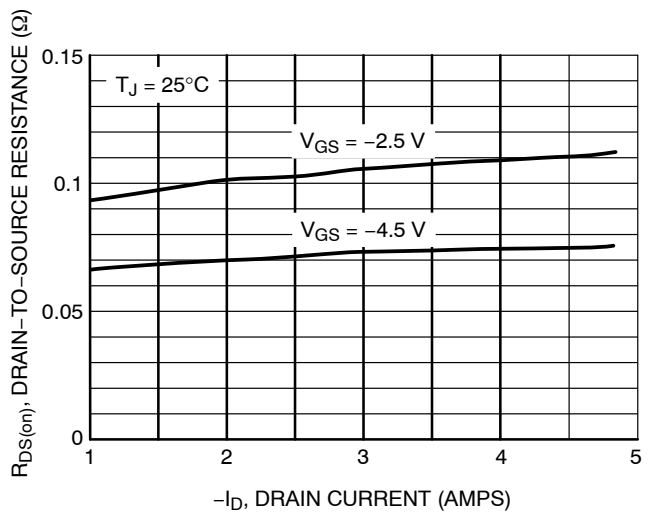


Figure 4. On-Resistance versus Drain Current and Gate Voltage

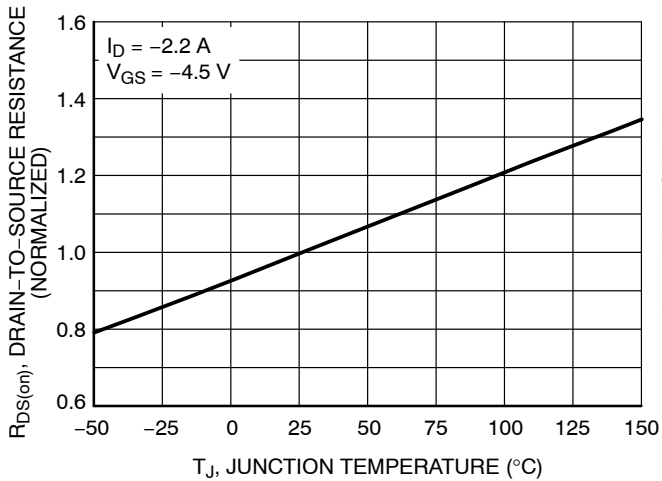


Figure 5. On-Resistance Variation with Temperature

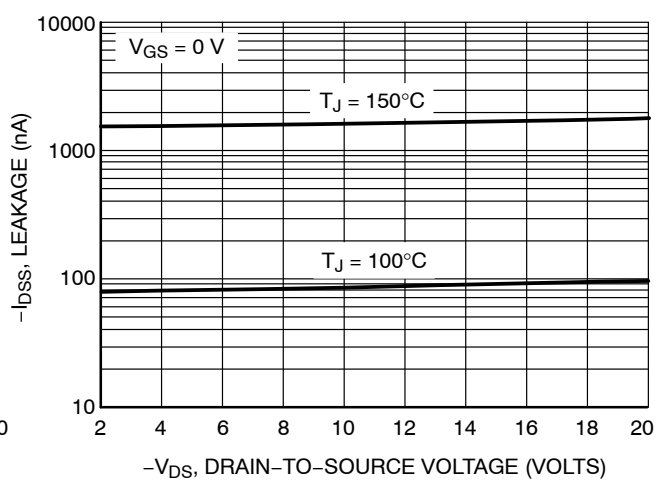


Figure 6. Drain-to-Source Leakage Current versus Voltage

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

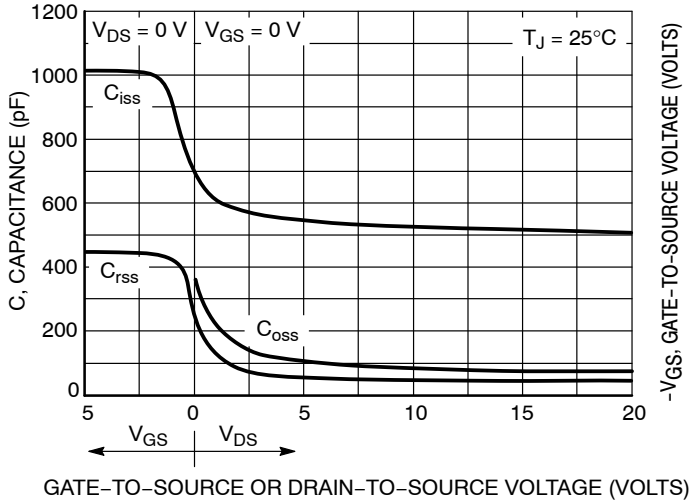


Figure 7. Capacitance Variation

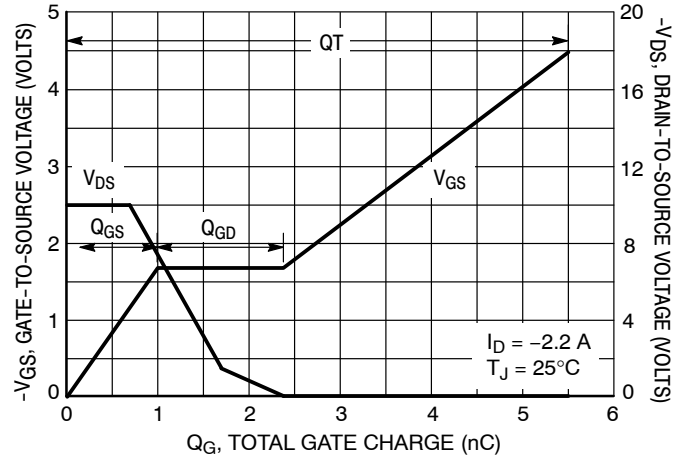


Figure 8. Gate-To-Source and Drain-To-Source Voltage versus Total Charge

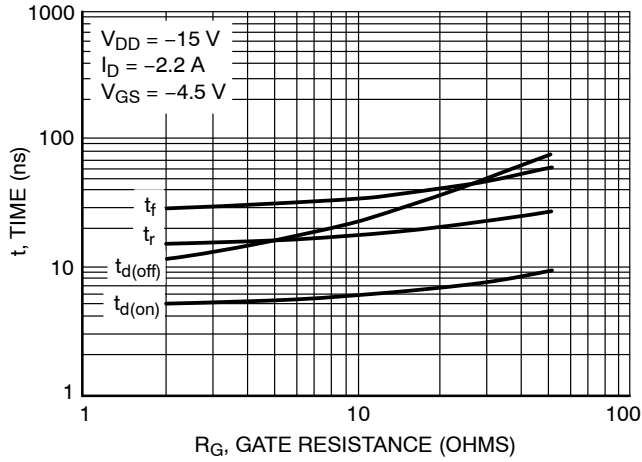


Figure 9. Resistive Switching Time Variation versus Gate Resistance

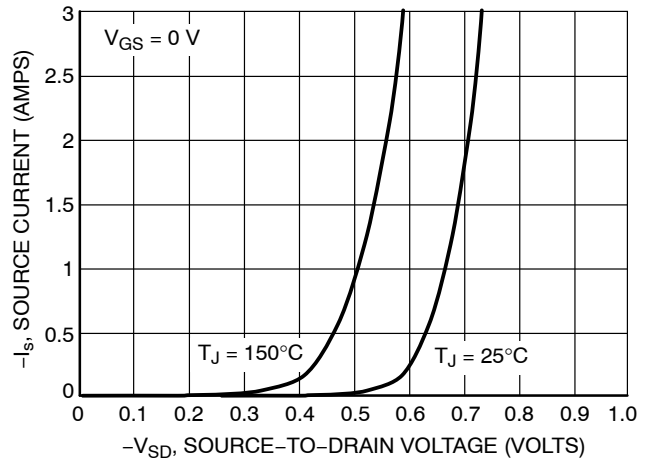


Figure 10. Diode Forward Voltage versus Current

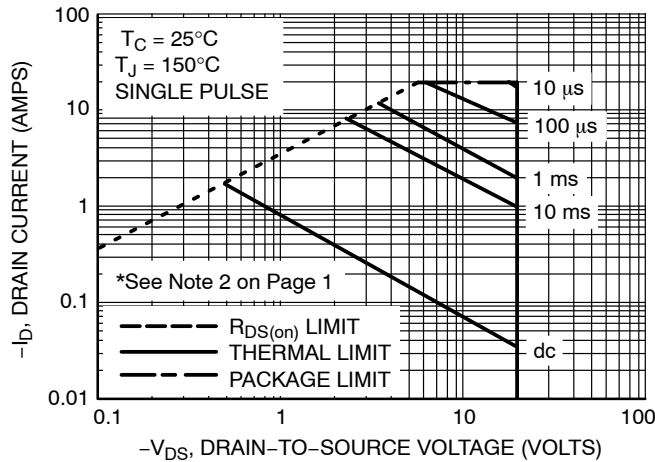


Figure 11. Maximum Rated Forward Biased Safe Operating Area

# NTLJF3117P

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

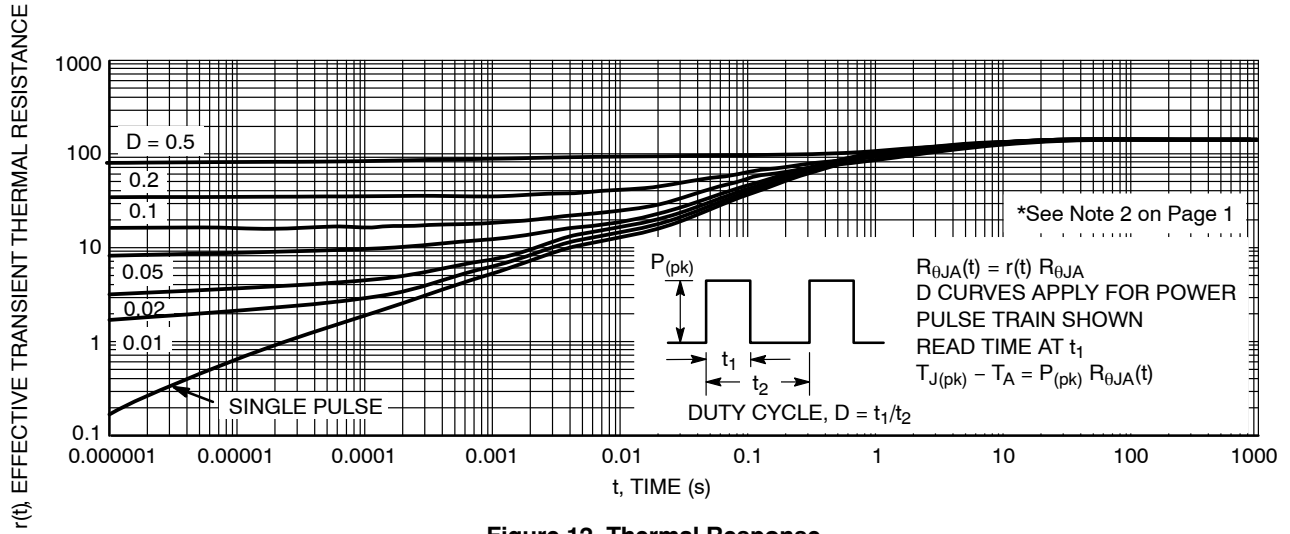


Figure 12. Thermal Response

# NTLJF3117P

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

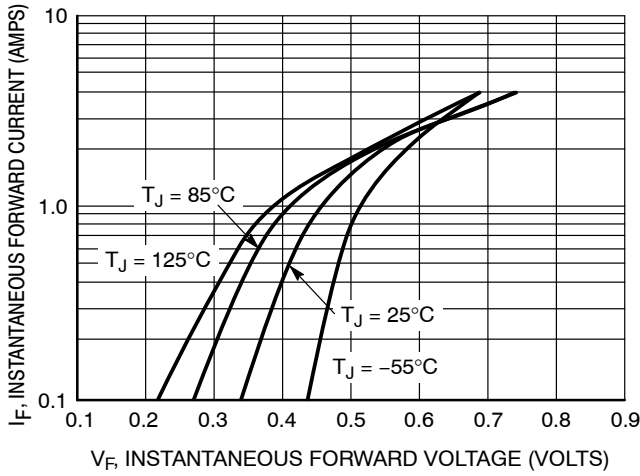


Figure 13. Typical Forward Voltage

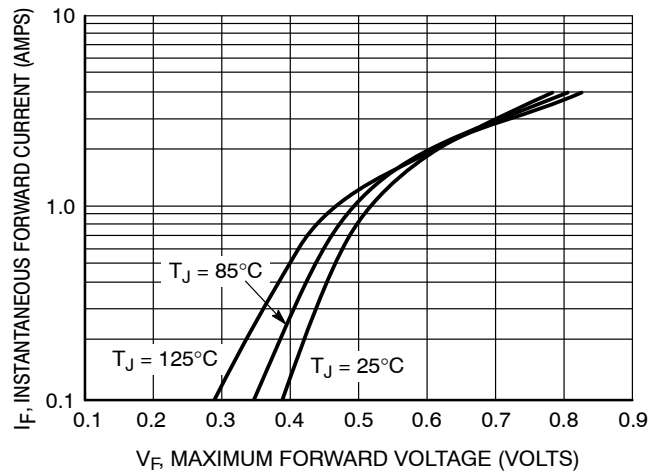


Figure 14. Maximum Forward Voltage

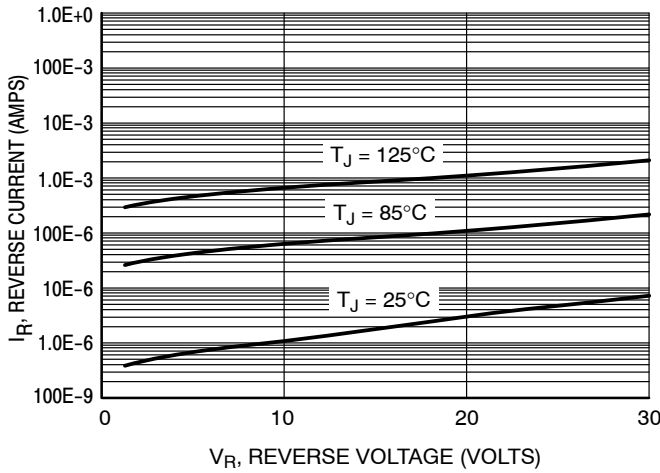


Figure 15. Typical Reverse Current

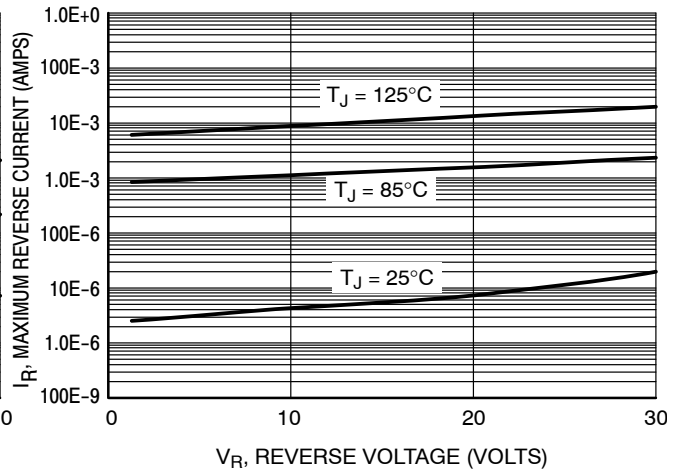


Figure 16. Maximum Reverse Current

### ORDERING INFORMATION

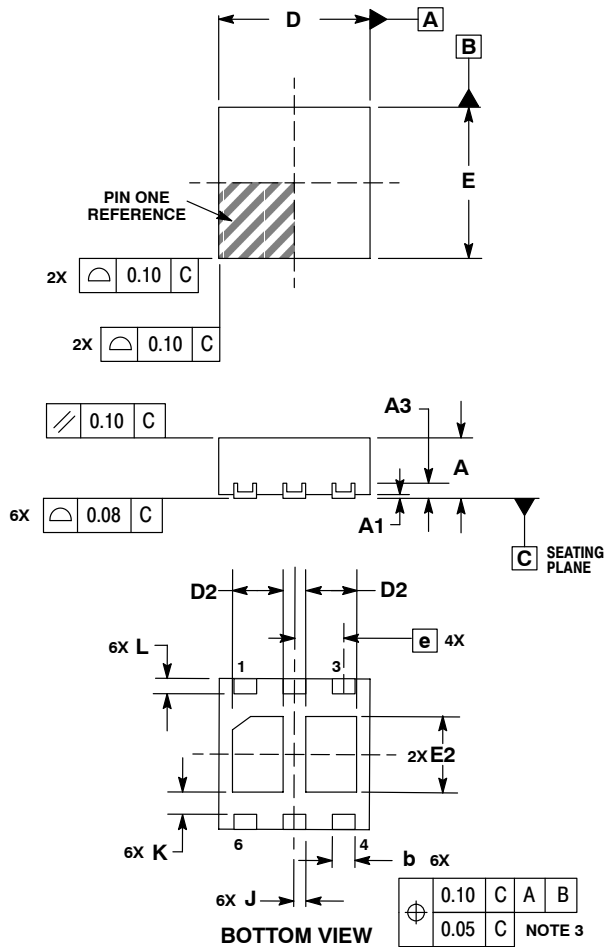
Device	Package	Shipping <sup>†</sup>
NTLJF3117PT1G	WDFN6 (Pb-Free)	3000 / Tape & Reel
NTLJF3117PTAG	WDFN6 (Pb-Free)	3000 / Tape & Reel

<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.

# NTLJF3117P

## PACKAGE DIMENSIONS

WDFN6 2x2  
CASE 506AN-01  
ISSUE C

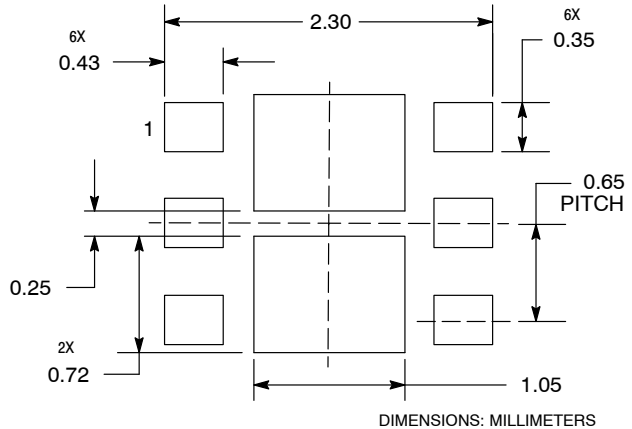


**NOTES:**

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



FETKY is a registered trademark of International Rectifier Corporation.  
μCool is a trademark of Semiconductor Components Industries, LLC (SCILLC).

**ON Semiconductor** and **ON** 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 5163, Denver, Colorado 80217 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** orderlit@onsemi.com

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5773-3850

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local Sales Representative