

# NTLJF3117P

## Power MOSFET and Schottky Diode

-20 V, -4.1 A, P-Channel, with 2.0 A Schottky Barrier Diode, 2x2 mm,  $\mu$ Cool™ Package

### Features

- FETKY™ Configuration with MOSFET plus Low Vf Schottky Diode
- $\mu$ COOL™ 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 ( $T_J = 25^\circ\text{C}$ 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	$T_A = 25^\circ\text{C}$	$I_D$	-3.3	A
		$T_A = 85^\circ\text{C}$		-2.4	
	$t \leq 5$ s	$T_A = 25^\circ\text{C}$		-4.1	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	1.5	W
		$t \leq 5$ s		2.3	
Continuous Drain Current (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	-2.3	A
		$T_A = 85^\circ\text{C}$		-1.6	
Power Dissipation (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	0.71	W
Pulsed Drain Current	$t_p = 10$ $\mu$ 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)		$I_S$	-1.9	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 mm<sup>2</sup>, 2 oz Cu.



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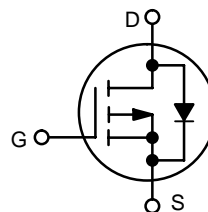
<http://onsemi.com>

### MOSFET

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX (Note 1)
-20 V	100 m $\Omega$ @ -4.5 V	-4.1 A
	135 m $\Omega$ @ -2.5 V	
	200 m $\Omega$ @ -1.8 V	

### SCHOTTKY DIODE

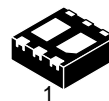
$V_R$ MAX	$V_F$ TYP	$I_F$ MAX
20 V	0.48 V	2.0 A



P-CHANNEL MOSFET

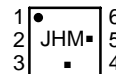


SCHOTTKY DIODE



WDFN6  
CASE 506AN

### MARKING DIAGRAM



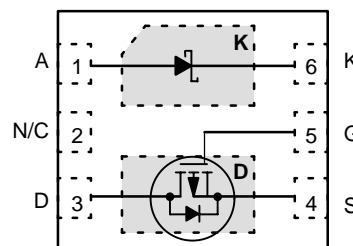
JH = Specific Device Code

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	$V_{RRM}$	20	V
DC Blocking Voltage	$V_R$	20	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)	$R_{\theta JA}$	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
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**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	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		-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	$I_R$	$V_R = 20\text{ V}$		3.0	8.0	$\mu\text{A}$
		$V_R = 10\text{ V}$		2.0	4.5	

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

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	$I_R$	$V_R = 20\text{ V}$		0.11	1.6	mA
		$V_R = 10\text{ V}$		0.06	1.2	

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

Maximum Instantaneous Forward Voltage	$V_F$	$I_F = 0.1\text{ A}$		0.20	0.29	V
		$I_F = 1.0\text{ A}$		0.40	0.47	
Maximum Instantaneous Reverse Current	$I_R$	$V_R = 20\text{ V}$		1.1	10.9	mA
		$V_R = 10\text{ V}$		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

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

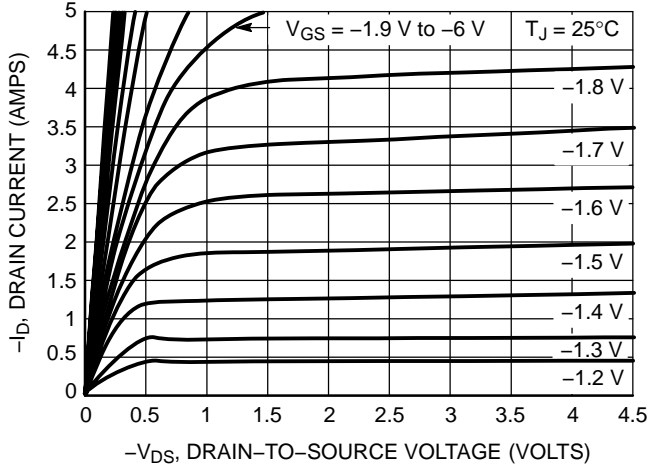


Figure 1. On-Region Characteristics

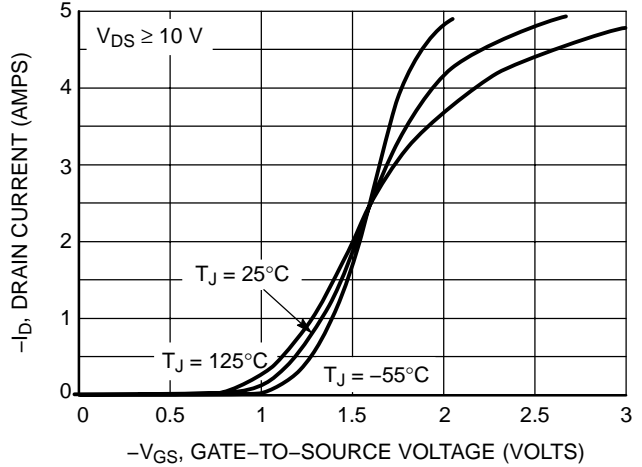


Figure 2. Transfer Characteristics

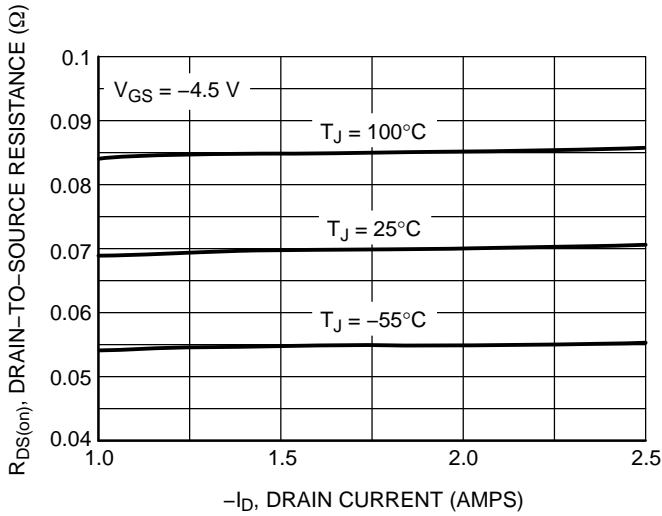


Figure 3. On-Resistance versus Drain Current

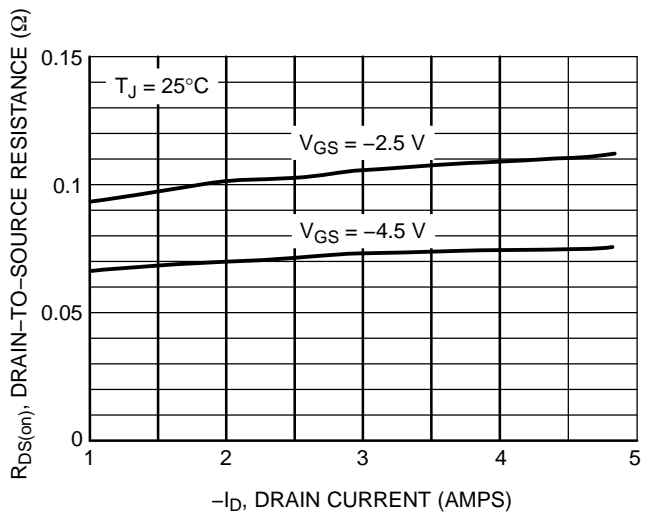


Figure 4. On-Resistance versus Drain Current and Gate Voltage

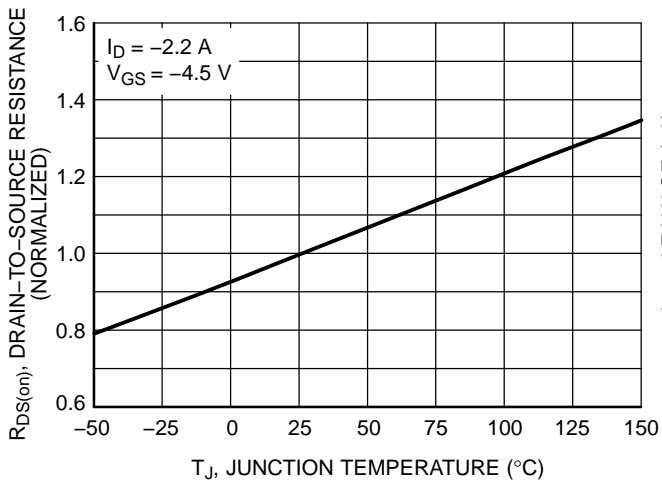


Figure 5. On-Resistance Variation with Temperature

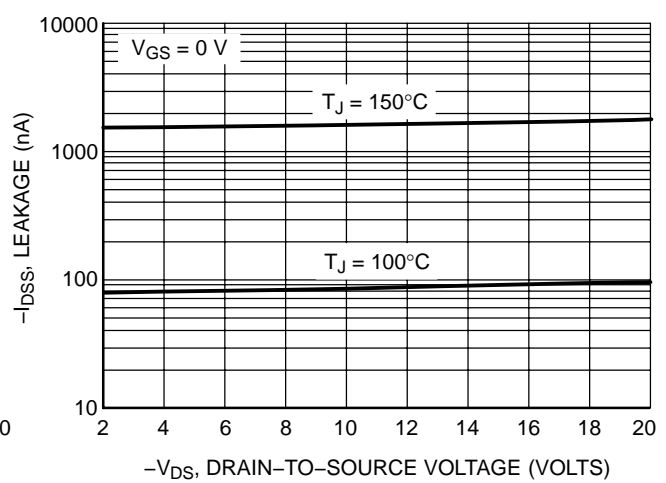


Figure 6. Drain-to-Source Leakage Current versus Voltage

# NTLJF3117P

## TYPICAL PERFORMANCE CURVES (T<sub>J</sub> = 25°C unless otherwise noted)

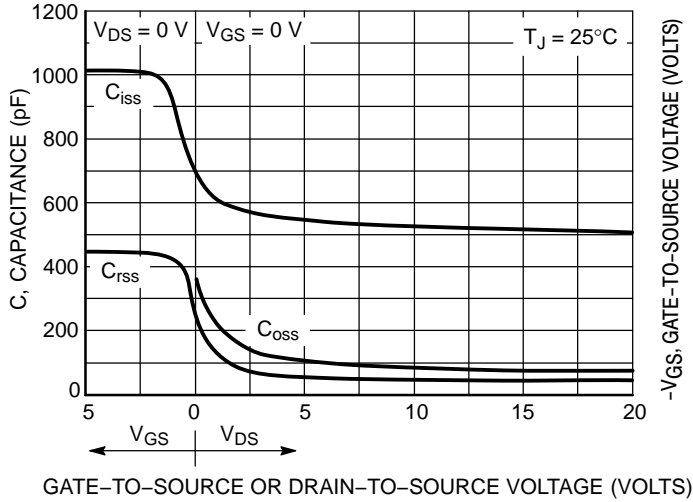


Figure 7. Capacitance Variation

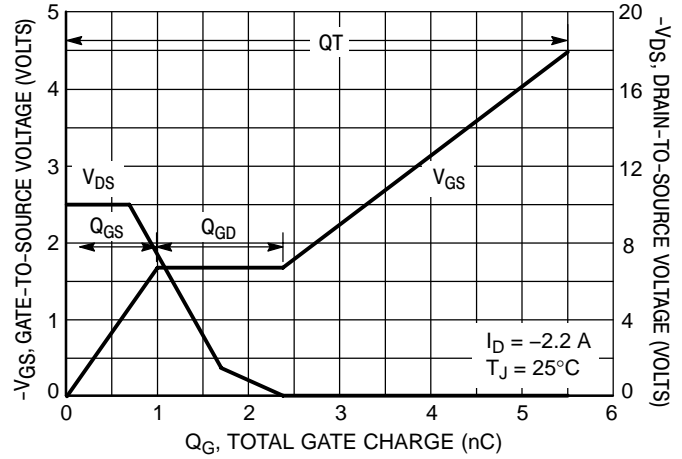


Figure 8. Gate-To-Source and Drain-To-Source Voltage versus Total Charge

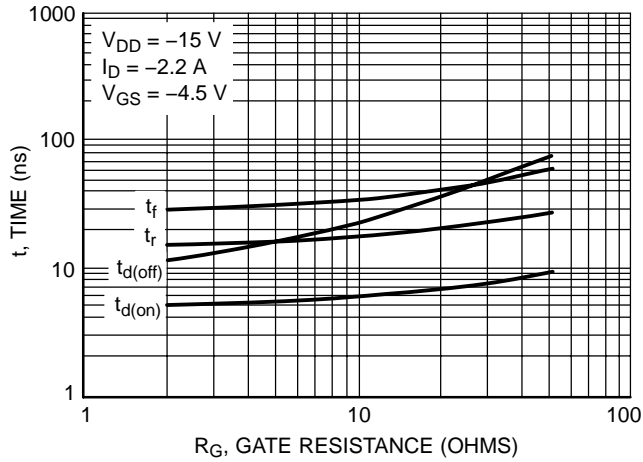


Figure 9. Resistive Switching Time Variation versus Gate Resistance

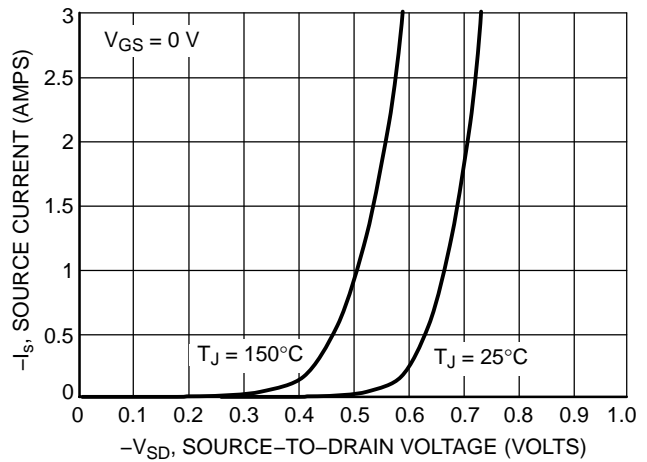


Figure 10. Diode Forward Voltage versus Current

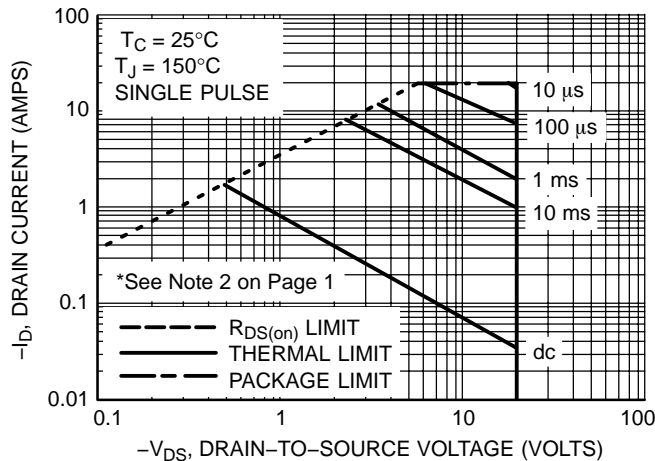


Figure 11. Maximum Rated Forward Biased Safe Operating Area

# NTLJF3117P

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

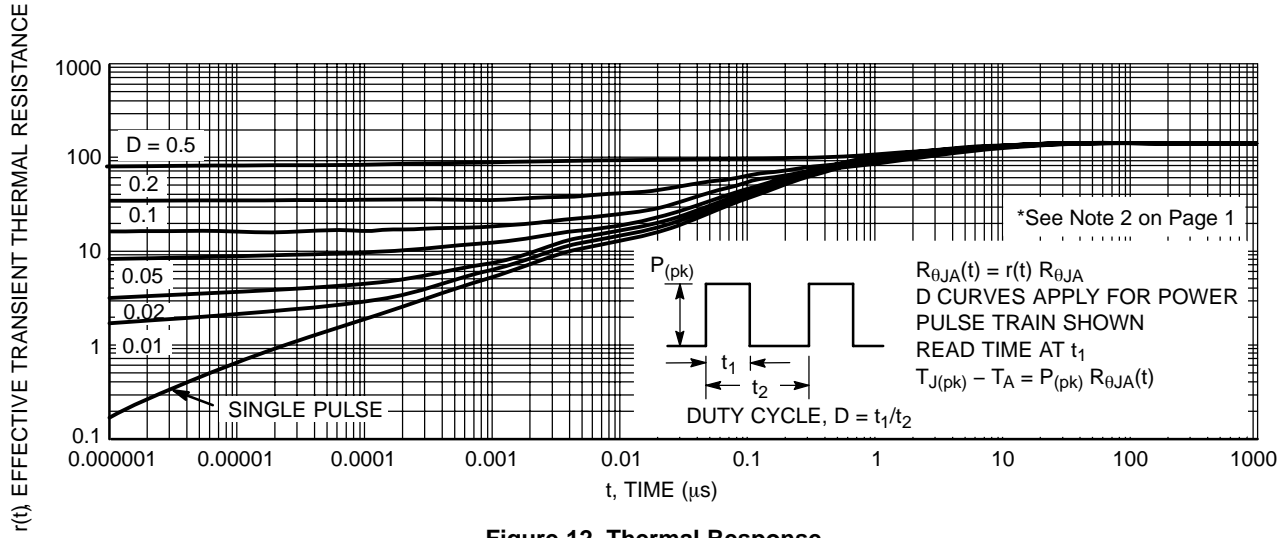


Figure 12. Thermal Response

# NTLJF3117P

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

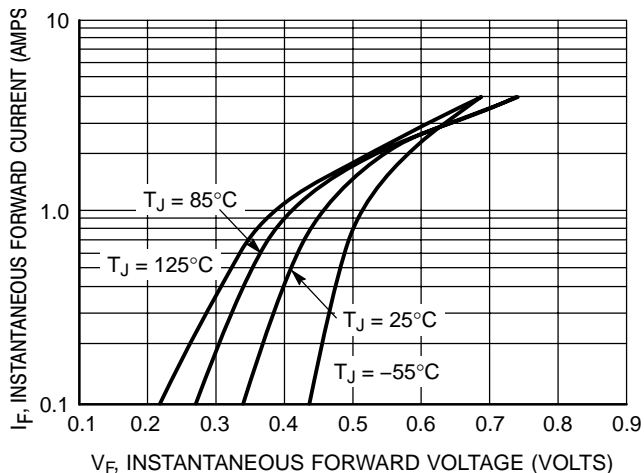


Figure 13. Typical Forward Voltage

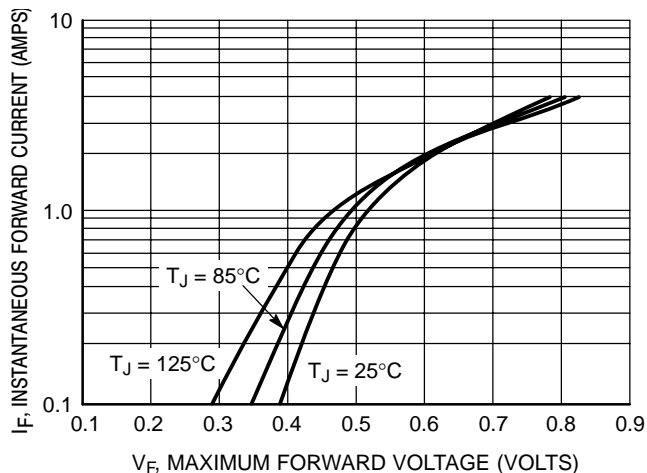


Figure 14. Maximum Forward Voltage

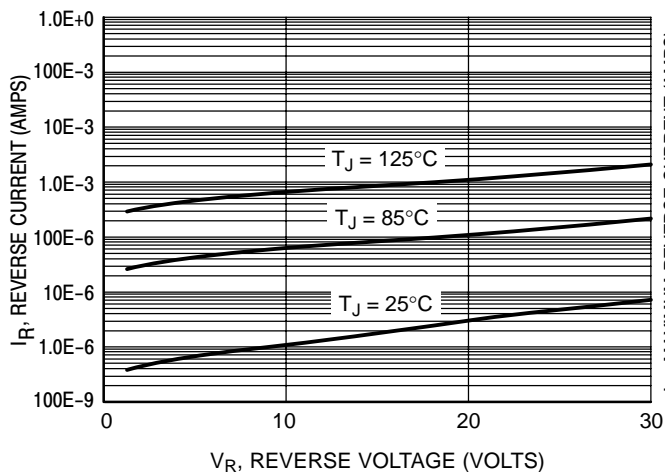


Figure 15. Typical Reverse Current

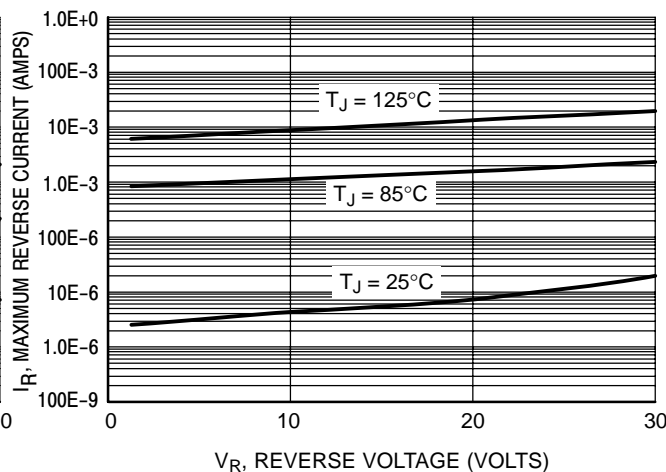


Figure 16. Maximum Reverse Current

### ORDERING INFORMATION

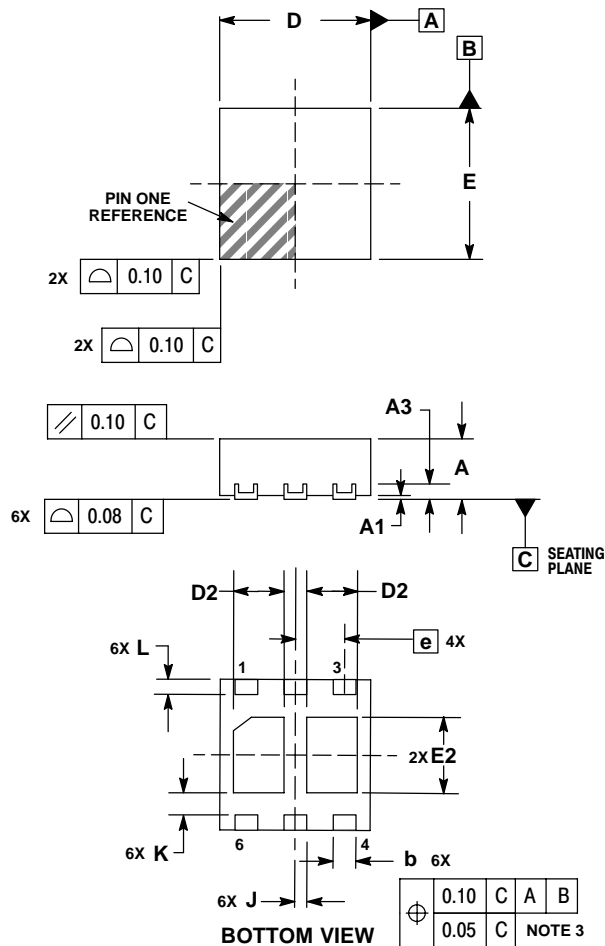
Device	Package	Shipping†
NTLJF3117PT1G	WDFN6 (Pb-Free)	3000 / Tape & Reel

†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.

## NTLJF3117P

## PACKAGE DIMENSIONS

WDFN6 2x2  
CASE 506AN-01  
ISSUE B

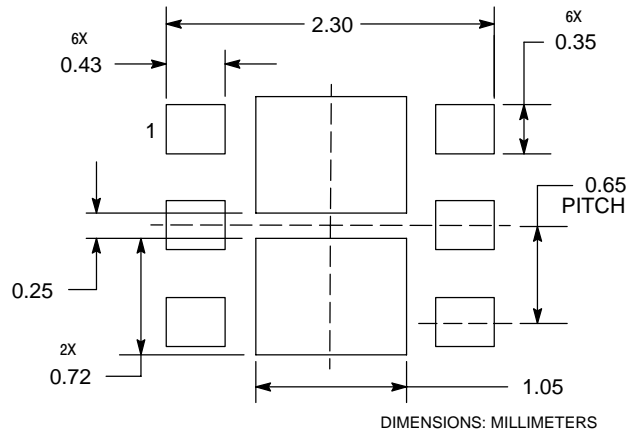


## NOTES:


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



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