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# NTLUF4189NZ

## Power MOSFET and Schottky Diode

30 V, N-Channel with 0.5 A Schottky Barrier Diode, 1.6 x 1.6 x 0.55 mm  $\mu$ Cool™ Package

### Features

- Low Qg and Capacitance to Minimize Switching Losses
- Low Profile UDFN 1.6x1.6 mm for Board Space Saving
- Low VF Schottky Diode
- ESD Protected Gate
- This is a Halide-Free Device
- This is a Pb-Free Device

### Applications

- DC-DC Boost Converter
- Color Display and Camera Flash Regulators
- Optimized for Power Management Applications for Portable Products, such as Cell Phones, PMP, DSC, GPS, and others

### MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise stated)

Parameter			Symbol	Value	Units
Drain-to-Source Voltage			V <sub>DSS</sub>	30	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>	1.5	A
		T <sub>A</sub> = 85°C		1.1	
	t ≤ 5 s	T <sub>A</sub> = 25°C		1.9	
Power Dissipation (Note 1)	Steady State	T <sub>A</sub> = 25°C	P <sub>D</sub>	0.8	W
		T <sub>A</sub> = 25°C		1.3	
Continuous Drain Current (Note 2)	Steady State	T <sub>A</sub> = 25°C	I <sub>D</sub>	1.2	A
		T <sub>A</sub> = 85°C		0.9	
Power Dissipation (Note 2)		T <sub>A</sub> = 25°C	P <sub>D</sub>	0.5	W
Pulsed Drain Current		t <sub>p</sub> = 10 μs	I <sub>DM</sub>	8.0	A
MOSFET Operating Junction and Storage Temperature			T <sub>J</sub> , T <sub>STG</sub>	-55 to 150	°C
Schottky Operating Junction & Storage Temperature			T <sub>J</sub> , T <sub>STG</sub>	-55 to 125	°C
Source Current (Body Diode) (Note 2)			I <sub>S</sub>	1.5	A
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T <sub>L</sub>	260	°C
Gate-to-Source ESD Rating (HBM) per JESD22-A114F			ESD	1000	V

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 [2 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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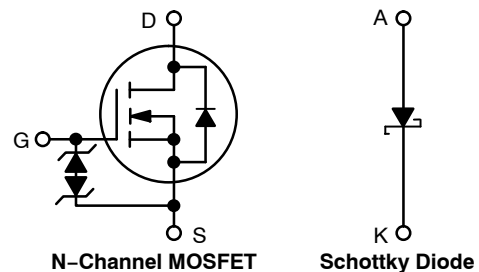
<http://onsemi.com>

### MOSFET

V <sub>(BR)DSS</sub>	R <sub>DS(on)</sub> MAX	I <sub>D</sub> MAX
30 V	200 mΩ @ 4.5 V	1.5 A
	250 mΩ @ 3.0 V	0.5 A
	350 mΩ @ 2.5 V	0.5 A

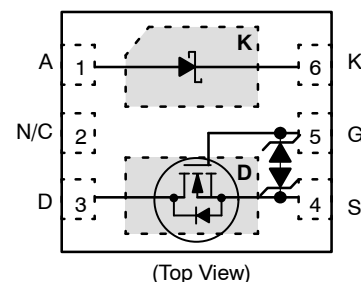
### SCHOTTKY DIODE

V <sub>R</sub> MAX	V <sub>F</sub> TYP	I <sub>F</sub> MAX
30 V	0.52 V	0.5 A



AA = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

### PIN CONNECTIONS



### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

# NTLUF4189NZ

## DEVICE ORDERING INFORMATION

Device	Package	Shipping†
NTLUF4189NZTAG	UDFN6 (Pb-Free)	3000 / Tape & Reel
NTLUF4189NZTBG	UDFN6 (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.

### Schottky Diode Maximum Ratings ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

Parameter	Symbol	Value	Units
Peak Repetitive Reverse Voltage	$V_{RRM}$	30	V
DC Blocking Voltage	$V_R$	30	V
Average Rectified Forward Current	$I_F$	0.5	A

### Thermal Resistance Ratings

Parameter	Symbol	Max	Units
Junction-to-Ambient – Steady State (Note 3)	$R_{\theta JA}$	155	$^\circ\text{C/W}$
Junction-to-Ambient – $t \leq 5$ s (Note 3)	$R_{\theta JA}$	100	
Junction-to-Ambient – Steady State min Pad (Note 4)	$R_{\theta JA}$	245	

### MOSFET Electrical Characteristics ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
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#### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0$ V, $I_D = 250$ $\mu\text{A}$	30			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = 250$ $\mu\text{A}$ , ref to $25^\circ\text{C}$		22		$\text{mV}/^\circ\text{C}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0$ V, $V_{DS} = 24$ 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			10	$\mu\text{A}$

#### ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}$ , $I_D = 250$ $\mu\text{A}$	0.4	1.1	1.5	V
Negative Threshold Temp. Coefficient	$V_{GS(TH)}/T_J$			3.0		$\text{mV}/^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 4.5$ V, $I_D = 1.5$ A		145	200	$\text{m}\Omega$
		$V_{GS} = 3.0$ V, $I_D = 0.5$ A		185	250	
		$V_{GS} = 2.5$ V, $I_D = 0.5$ A		220	350	
Forward Transconductance	$g_{FS}$	$V_{DS} = 4.0$ V, $I_D = 0.15$ A		1.1		S

#### CHARGES & CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0$ V, $f = 1$ MHz, $V_{DS} = 15$ V		95		$\text{pF}$
Output Capacitance	$C_{OSS}$			15		
Reverse Transfer Capacitance	$C_{RSS}$			10		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5$ V, $V_{DS} = 15$ V; $I_D = 1.5$ A		1.4	3.0	$\text{nC}$
Threshold Gate Charge	$Q_{G(TH)}$			0.2		
Gate-to-Source Charge	$Q_{GS}$			0.4		
Gate-to-Drain Charge	$Q_{GD}$			0.4		

- 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.
- Pulse Test: pulse width  $\leq 300$   $\mu\text{s}$ , duty cycle  $\leq 2\%$
- Switching characteristics are independent of operating junction temperatures

# NTLUF4189NZ

## MOSFET Electrical Characteristics (T<sub>J</sub> = 25°C unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
<b>SWITCHING CHARACTERISTICS, V<sub>GS</sub> = 4.5 V (Note 6)</b>						
Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = 4.5 V, V <sub>DD</sub> = 15 V, I <sub>D</sub> = 1A, R <sub>G</sub> = 6 Ω		7.0		ns
Rise Time	t <sub>r</sub>			4.5		
Turn-Off Delay Time	t <sub>d(OFF)</sub>			10.2		
Fall Time	t <sub>f</sub>			1.2		

## DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 1A	T <sub>J</sub> = 25°C		0.8	1.2	V
			T <sub>J</sub> = 85°C		0.75		
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, dI <sub>SD</sub> /dt = 100 A/μs, I <sub>S</sub> = 1 A		10.5		ns	
Charge Time	t <sub>a</sub>			8.9			
Discharge Time	t <sub>b</sub>			1.6			
Reverse Recovery Charge	Q <sub>RR</sub>			2.1			nC

## SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Maximum Instantaneous Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 10 mA		0.27	0.37	V
		I <sub>F</sub> = 100 mA		0.36	0.46	
		I <sub>F</sub> = 500 mA		0.52	0.62	
Maximum Instantaneous Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 10 V		2.0	10	μA
		V <sub>R</sub> = 30 V		20	200	

## SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 85°C unless otherwise specified)

Maximum Instantaneous Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 10 mA		0.2		V
		I <sub>F</sub> = 100 mA		0.3		
		I <sub>F</sub> = 500 mA		0.51		
Maximum Instantaneous Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 10 V		80		μA
		V <sub>R</sub> = 30 V		525		

## SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 125°C unless otherwise specified)

Maximum Instantaneous Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 10 mA		0.14		V
		I <sub>F</sub> = 100 mA		0.27		
		I <sub>F</sub> = 500 mA		0.51		
Maximum Instantaneous Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 10 V		600		μA
		V <sub>R</sub> = 30 V		3000		

## SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified)

Capacitance	C	V <sub>R</sub> = 5 V, f = 1.0 MHz		6.0		pF
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- 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.
- Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%
- Switching characteristics are independent of operating junction temperatures

# NTLUF4189NZ

## TYPICAL MOSFET CHARACTERISTICS

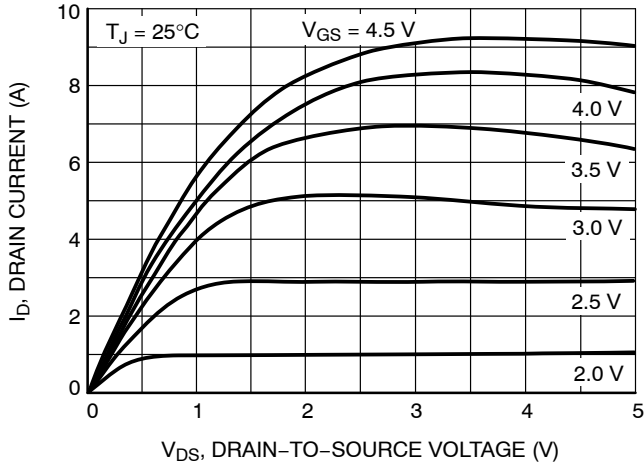


Figure 1. On-Region Characteristics

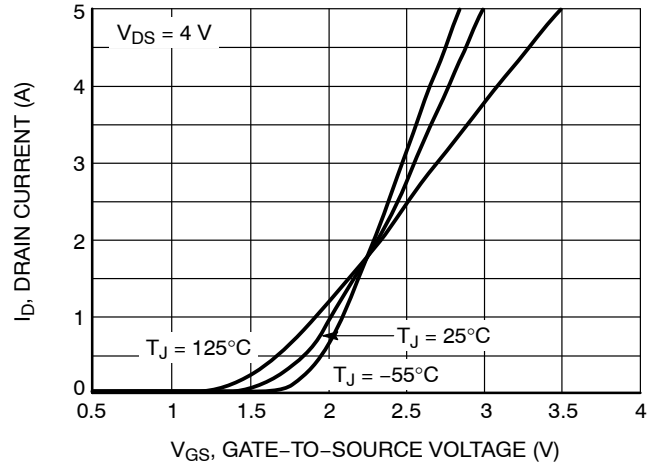


Figure 2. Transfer Characteristics

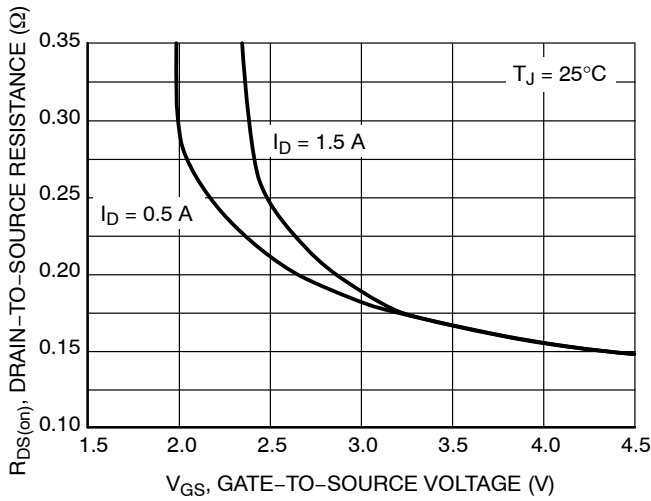


Figure 3. On-Resistance vs. Gate Voltage

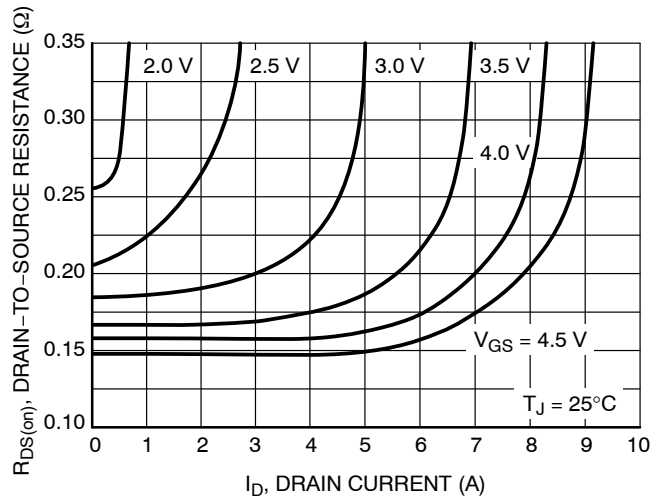


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

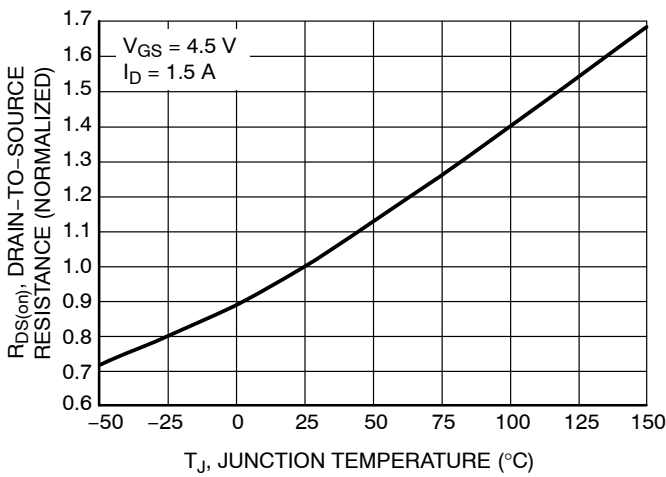


Figure 5. On-Resistance Variation with Temperature

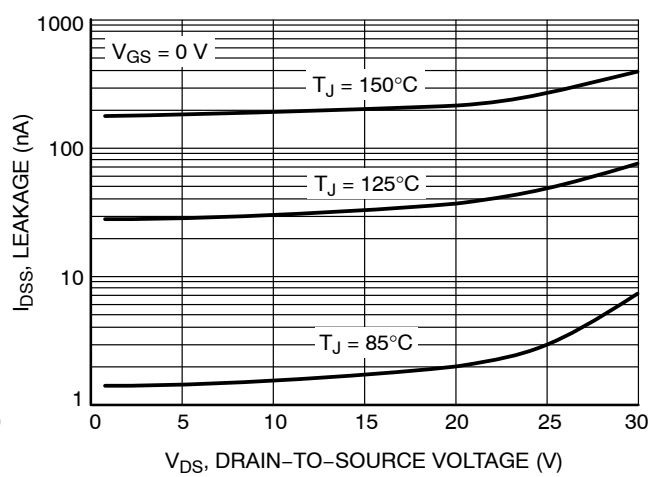


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTLUF4189NZ

## TYPICAL MOSFET CHARACTERISTICS

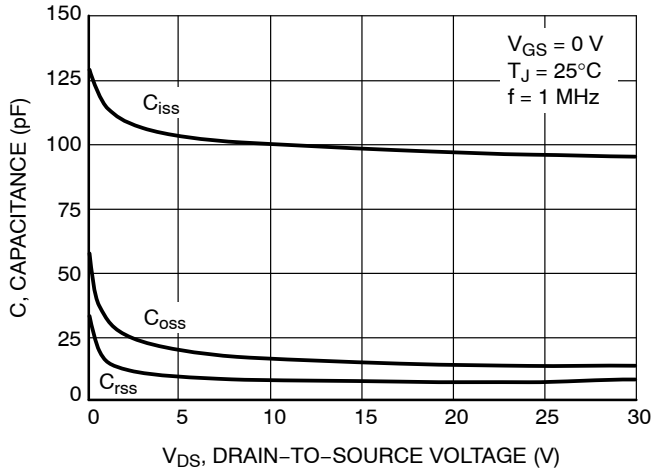


Figure 7. Capacitance Variation

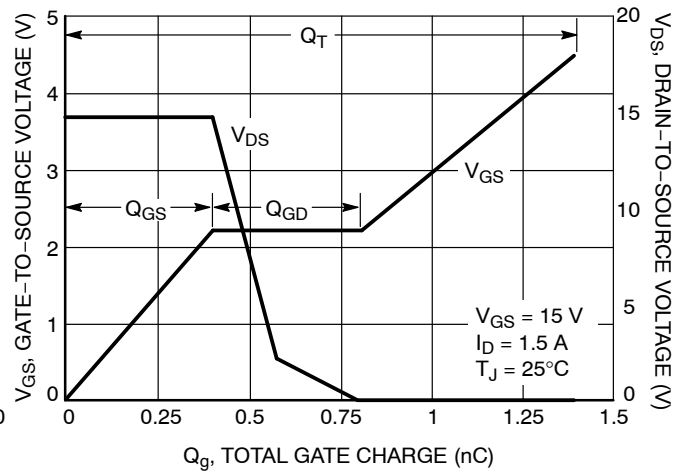


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

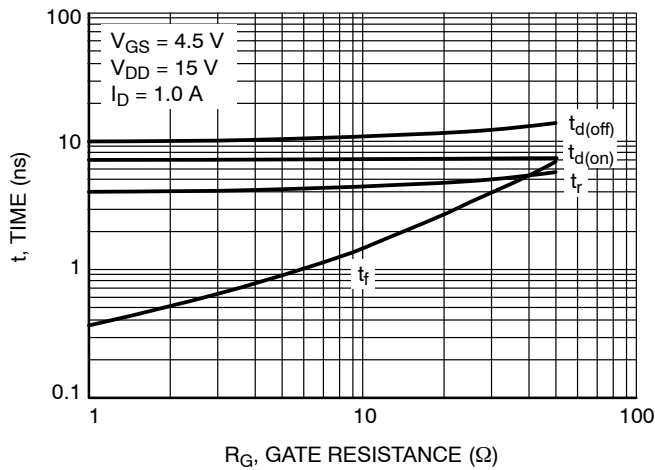


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

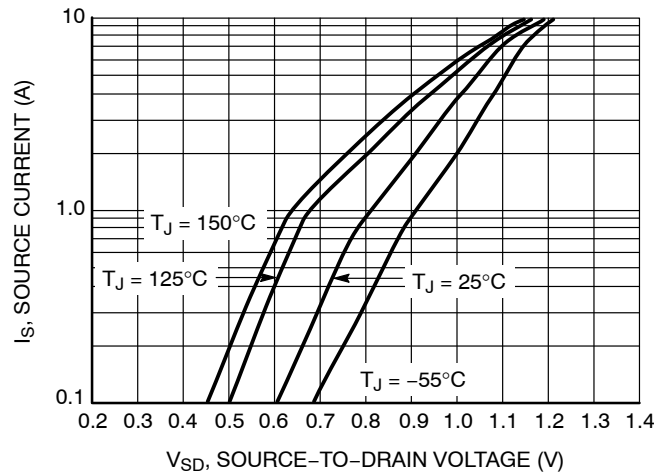


Figure 10. Diode Forward Voltage vs. Current

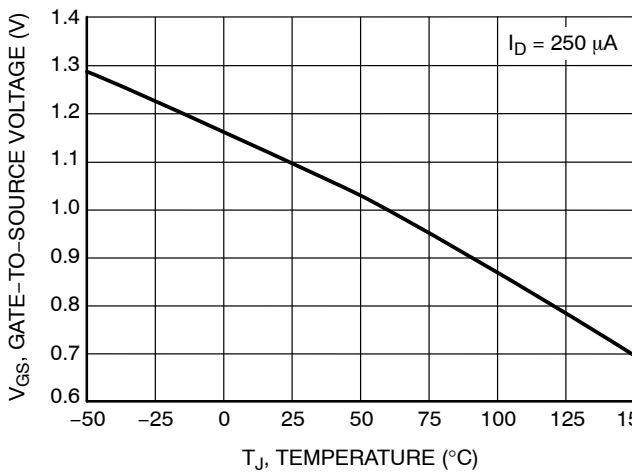


Figure 11. Threshold Voltage

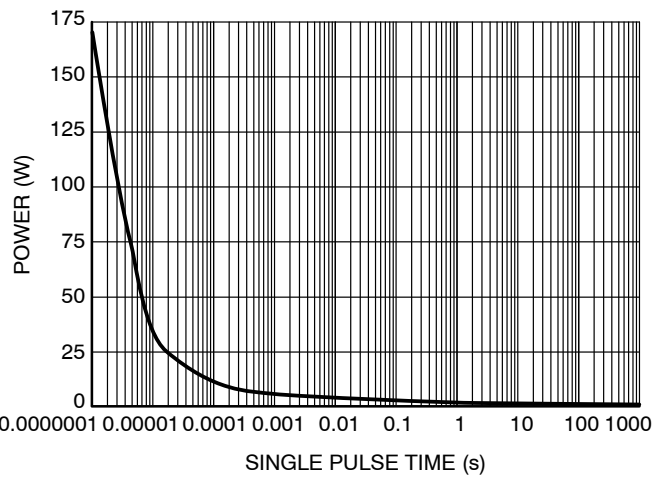


Figure 12. Single Pulse Maximum Power Dissipation

# NTLUF4189NZ

## TYPICAL MOSFET CHARACTERISTICS

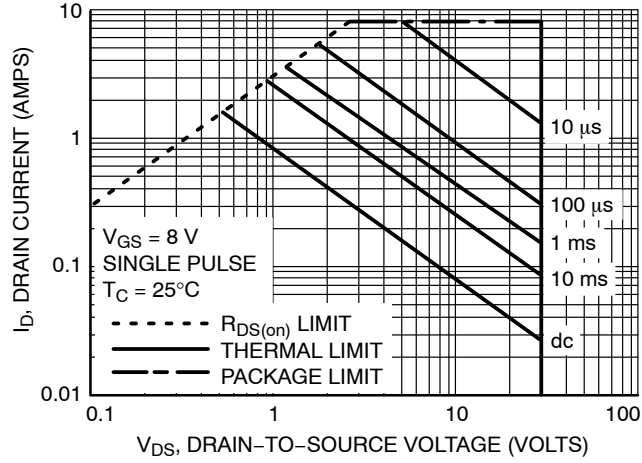


Figure 13. Maximum Rated Forward Biased Safe Operating Area

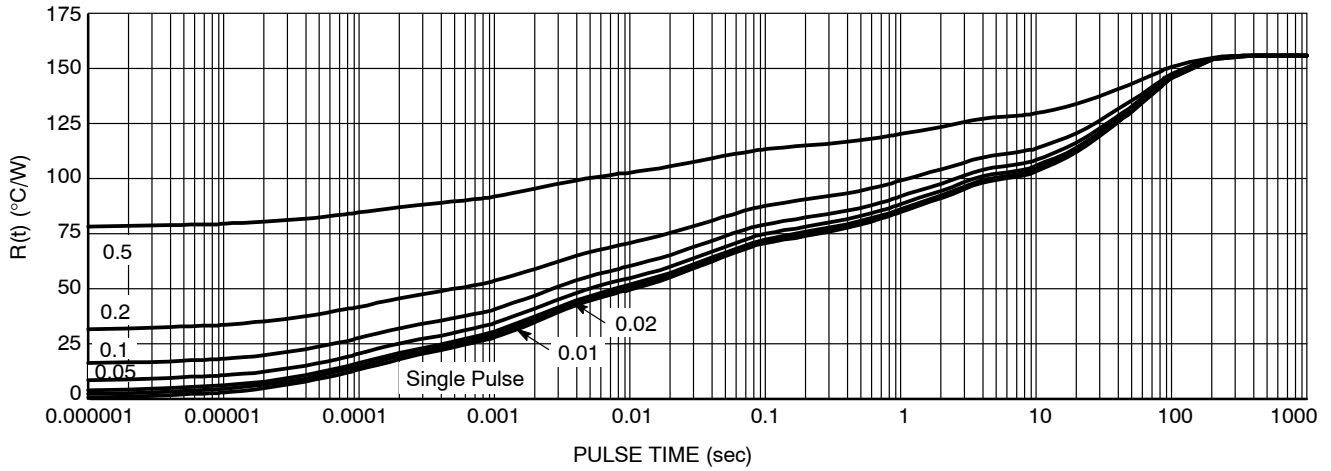


Figure 14. FET Thermal Response

# NTLUF4189NZ

## TYPICAL SCHOTTKY CHARACTERISTICS

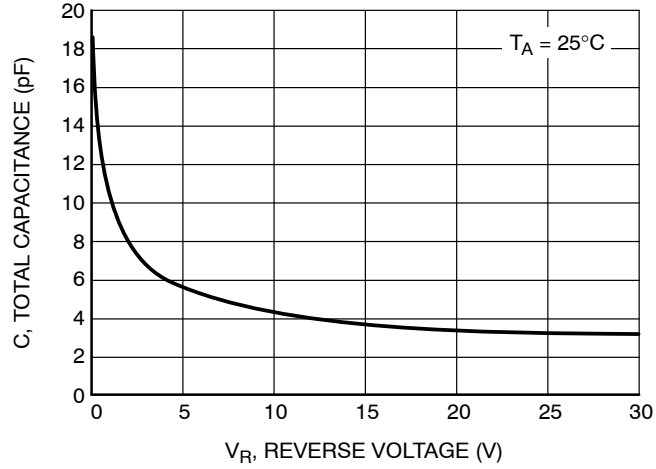


Figure 15. Total Capacitance

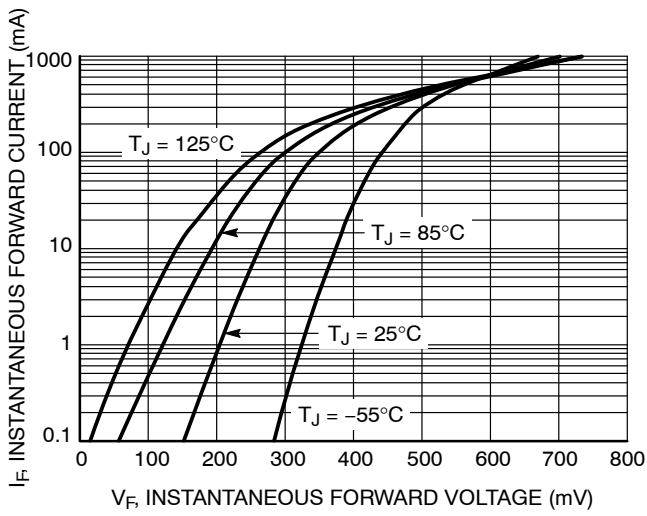


Figure 16. Typical Forward Voltage

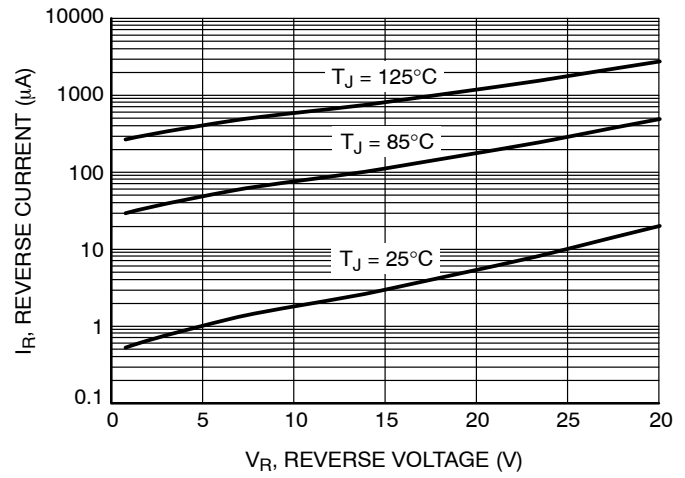


Figure 17. Typical Reverse Current



# MECHANICAL CASE OUTLINE

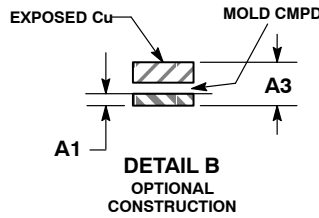
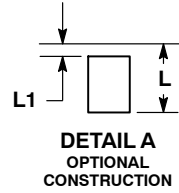
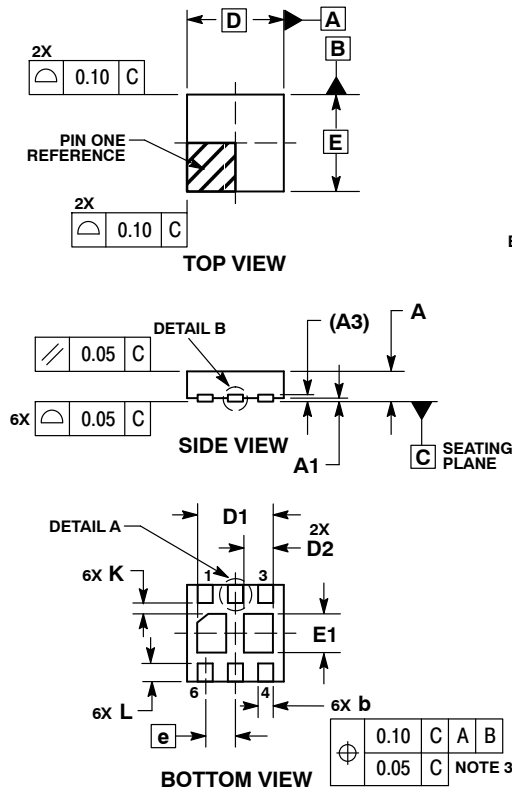
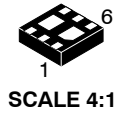
## PACKAGE DIMENSIONS

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### UDFN6 1.6x1.6, 0.5P CASE 517AT-01 ISSUE O

DATE 02 SEP 2008

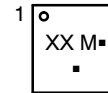


**NOTES:**

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 TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

MILLIMETERS		
DIM	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.13	REF
b	0.20	0.30
D	1.60	BSC
E	1.60	BSC
e	0.50	BSC
D1	1.14	1.34
D2	0.38	0.58
E1	0.54	0.74
K	0.20	---
L	0.15	0.35
L1	---	0.10

### GENERIC MARKING DIAGRAM\*

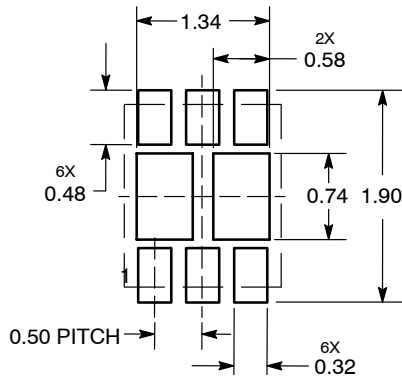


- XX = Specific Device Code
- M = Date Code
- = Pb-Free Package

(Note: Microdot may be in either location)

\*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.



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

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<b>DESCRIPTION:</b>	<b>6 PIN UDFN, 1.6X1.6, 0.5P</b>	<b>PAGE 1 OF 1</b>

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