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# NTNS3C94NZ

## MOSFET – Single N-Channel, Small Signal, XLLGA3, 0.62 x 0.62 x 0.4 mm 12 V, 384 mA

### Features

- Single N-Channel MOSFET
- Ultra Small and Thin Package (0.62 x 0.62 x 0.4 mm)
- Low  $R_{DS(on)}$  Solution in 0.62 x 0.62 mm Package
- 1.8 V Gate Voltage Rating
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

- Small Signal Load Switch
- Analog Switch
- High Speed Interfacing
- Optimized for Power Management in Ultra Portable Products

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

Parameter		Symbol	Value	Units	
Drain-to-Source Voltage		$V_{DSS}$	12	V	
Gate-to-Source Voltage		$V_{GS}$	$\pm 8$	V	
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	384	mA
				$T_A = 85^\circ\text{C}$	
	$t \leq 5\text{ s}$	$T_A = 25^\circ\text{C}$		413	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	120	mW
				$T_A = 25^\circ\text{C}$	
	$t \leq 5\text{ s}$	$T_A = 25^\circ\text{C}$			
Pulsed Drain Current		$t_p = 10\ \mu\text{s}$	$I_{DM}$	115	A
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-55 to 150		$^\circ\text{C}$
Source Current (Body Diode) (Note 2)		$I_S$	157		mA
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260		$^\circ\text{C}$

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.

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Units
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	1040	$^\circ\text{C}/\text{W}$
Junction-to-Ambient – $t \leq 5\text{ s}$ (Note 1)	$R_{\theta JA}$	900	

1. Surface Mounted on FR4 Board using the minimum recommended pad size, (or  $2\text{ mm}^2$ ), 1 oz Cu.
2. Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .



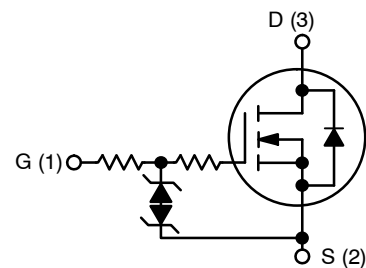
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### MOSFET

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
12 V	0.48 $\Omega$ @ 4.5 V	384 mA
	0.54 $\Omega$ @ 3.7 V	
	0.60 $\Omega$ @ 3.3 V	
	0.80 $\Omega$ @ 2.5 V	
	1.90 $\Omega$ @ 1.8 V	

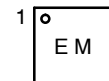
### N-Channel MOSFET



### MARKING DIAGRAM



XLLGA3  
CASE 713AE



E = Specific Device Code  
M = Date Code

### ORDERING INFORMATION

Device	Package	Shipping†
NTNS3C94NZT5G	XLLGA3 (Pb-Free)	8000 / 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.

# NTNS3C94NZ

## 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	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	12			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = 250\ \mu\text{A}, \text{ref to } 25^\circ\text{C}$		11		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 9.6\text{ V}$ $T_J = 25^\circ\text{C}$			100	nA
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 10\text{ V}$			$\pm 10$	$\mu\text{A}$

### ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	0.4		1.0	V
Negative Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			0.8		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 100\text{ mA}$		0.35	0.48	$\Omega$
		$V_{GS} = 3.7\text{ V}, I_D = 75\text{ mA}$		0.40	0.54	
		$V_{GS} = 3.3\text{ V}, I_D = 75\text{ mA}$		0.43	0.60	
		$V_{GS} = 2.5\text{ V}, I_D = 50\text{ mA}$		0.55	0.80	
		$V_{GS} = 1.8\text{ V}, I_D = 20\text{ mA}$		1.0	1.9	
		$V_{GS} = 1.5\text{ V}, I_D = 10\text{ mA}$		1.8		
Forward Transconductance	$g_{FS}$	$V_{DS} = 5\text{ V}, I_D = 100\text{ mA}$		0.6		S
Source-Drain Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 100\text{ mA}$		0.76	1.0	V

### CHARGES & CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 9.6\text{ V}$		35		$\mu\text{F}$
Output Capacitance	$C_{OSS}$			6.0		
Reverse Transfer Capacitance	$C_{RSS}$			4.1		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 9.6\text{ V}, I_D = 100\text{ mA}$		0.6		nC
Threshold Gate Charge	$Q_{G(TH)}$			0.1		
Gate-to-Source Charge	$Q_{GS}$			0.1		
Gate-to-Drain Charge	$Q_{GD}$			0.1		

### SWITCHING CHARACTERISTICS, $V_{GS} = 4.5\text{ V}$ (Note 3)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DD} = 9.6\text{ V}, I_D = 100\text{ mA}, R_G = 2\ \Omega$		7.0		$\text{ns}$
Rise Time	$t_r$			6.3		
Turn-Off Delay Time	$t_{d(OFF)}$			152		
Fall Time	$t_f$			80		

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.

3. Switching characteristics are independent of operating junction temperatures.

# NTNS3C94NZ

## TYPICAL CHARACTERISTICS

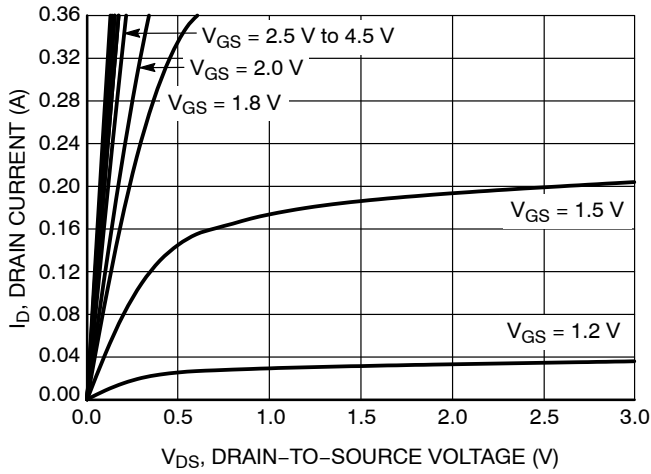


Figure 1. On-Region Characteristics

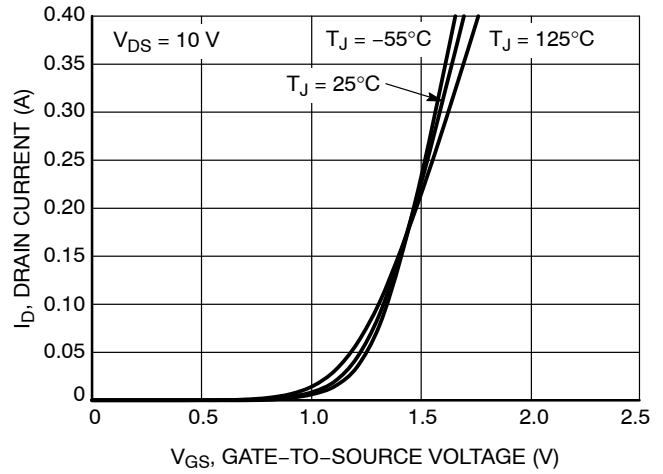


Figure 2. Transfer Characteristics

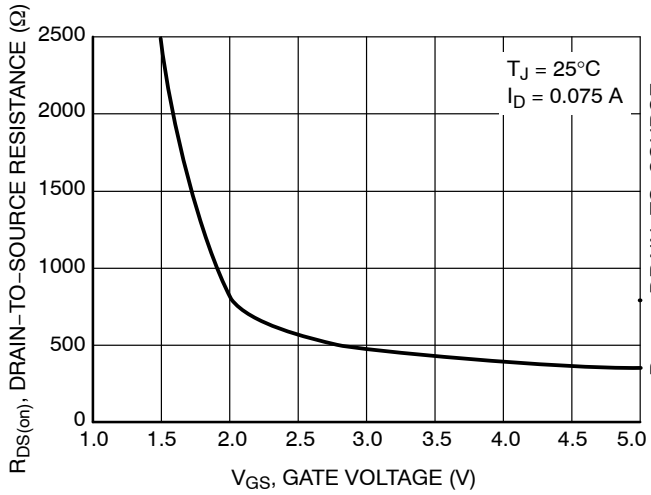


Figure 3. On-Resistance vs. Gate-to-Source Voltage

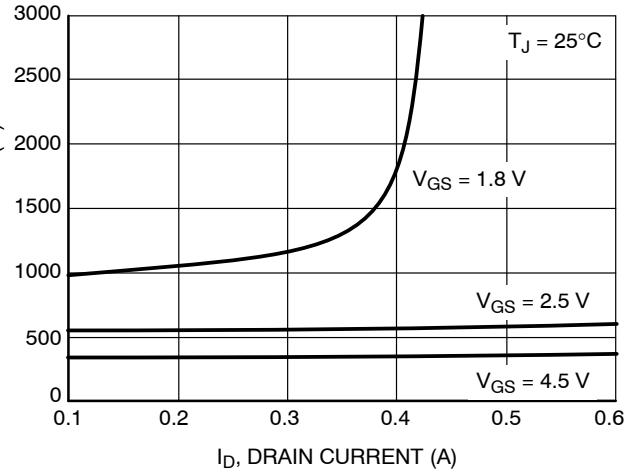


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

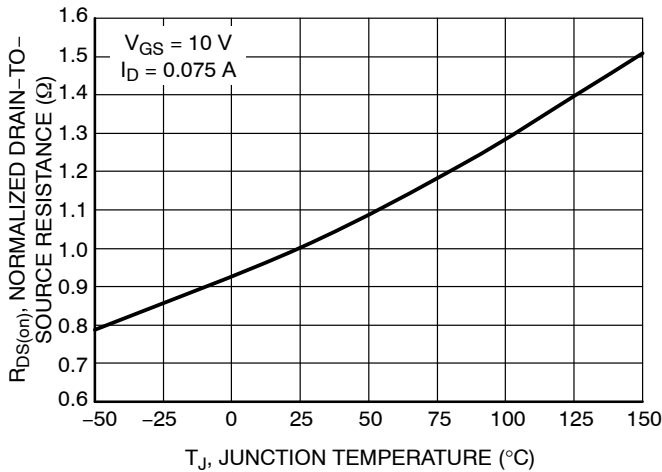


Figure 5. On-Resistance Variation with Temperature

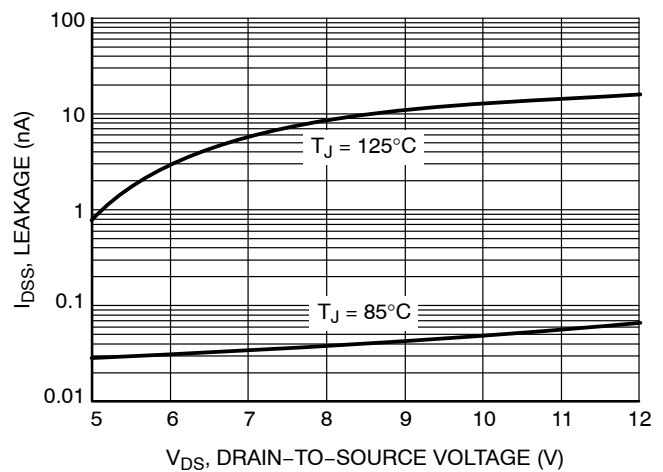
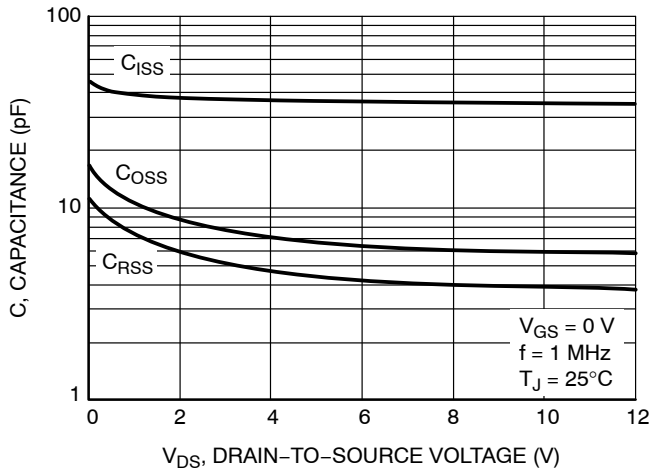


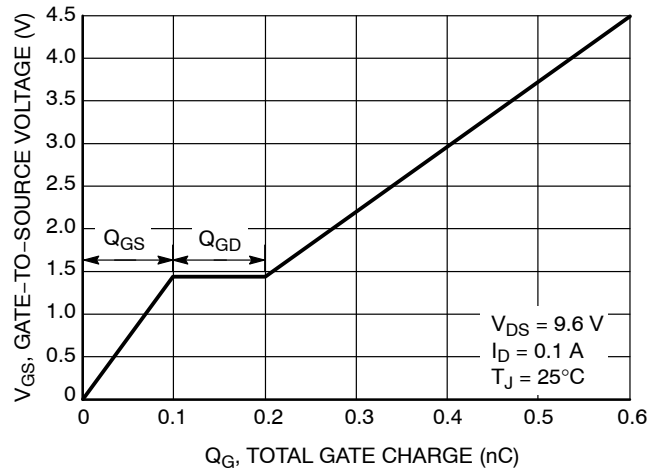
Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTNS3C94NZ

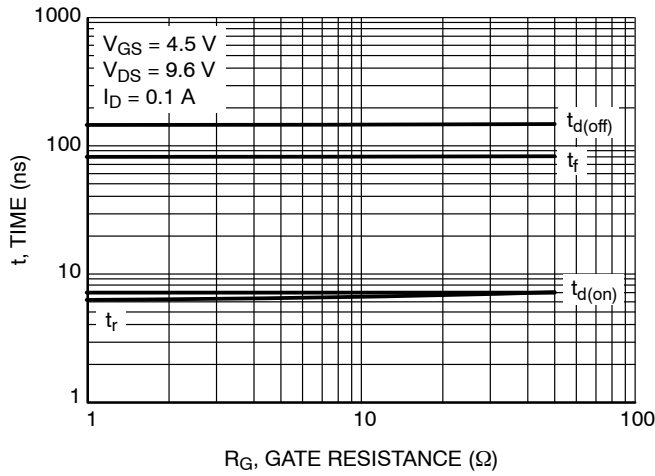
## TYPICAL CHARACTERISTICS



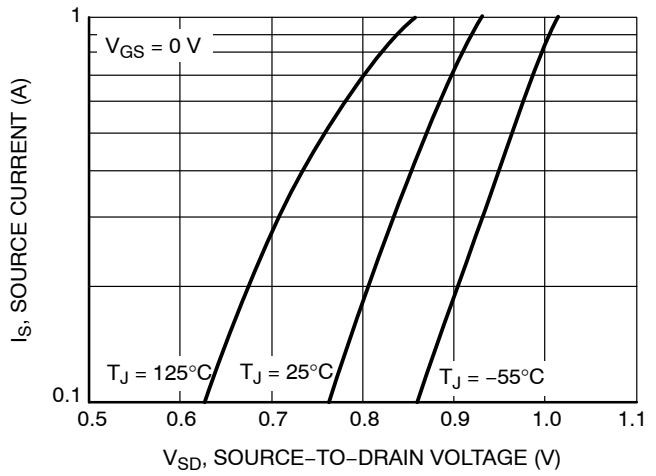
**Figure 7. Capacitance Variation**



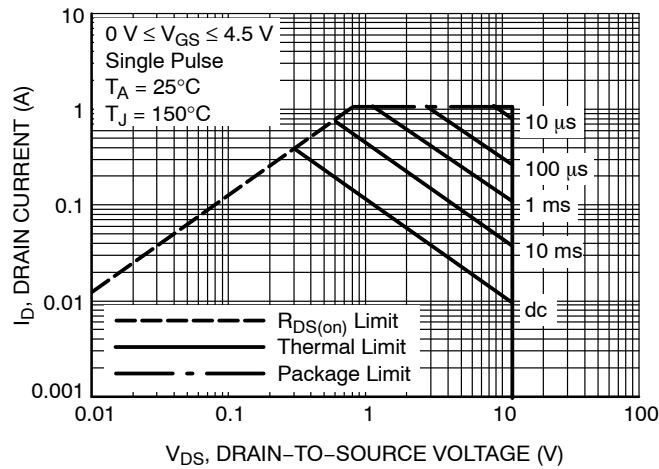
**Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**



**Figure 10. Diode Forward Voltage vs. Current**



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**

# NTNS3C94NZ

## TYPICAL CHARACTERISTICS

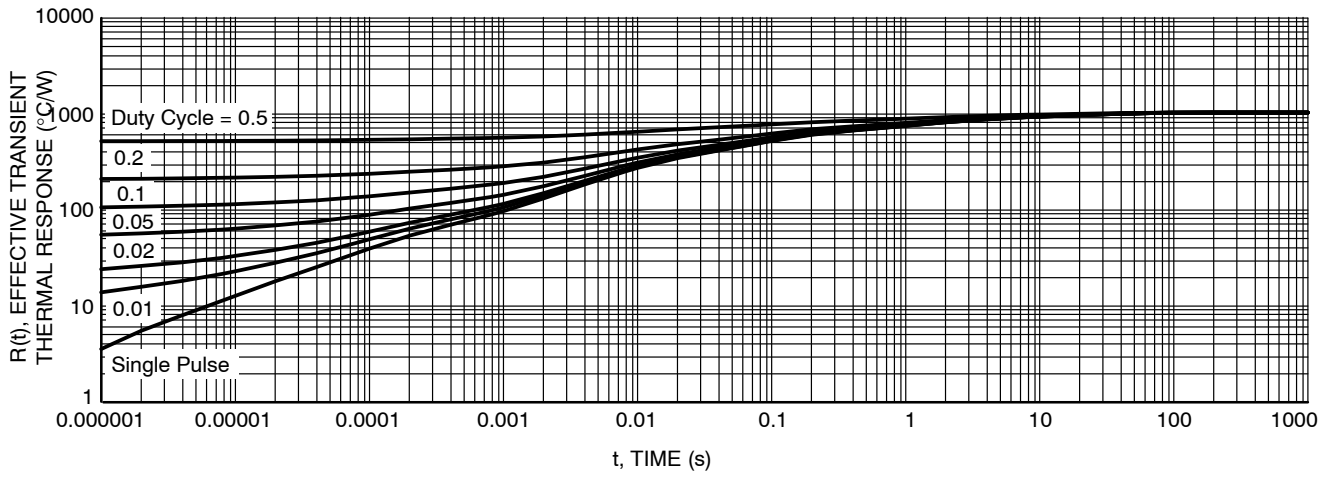
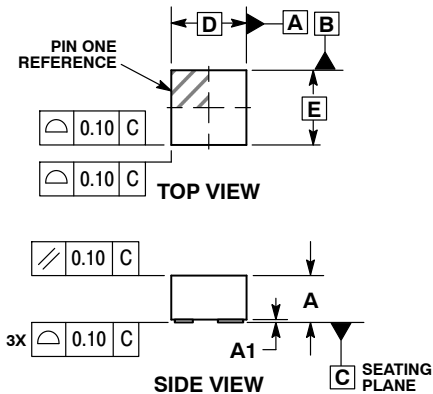


Figure 12. FET Thermal Response

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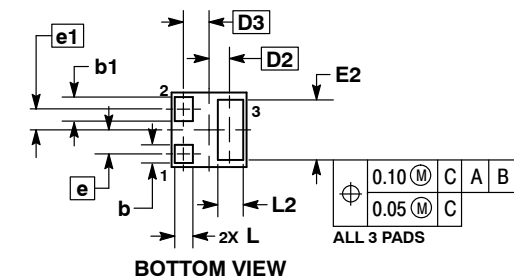
## PACKAGE DIMENSIONS

**XLLGA3, 0.62x0.62**  
CASE 713AE  
ISSUE O

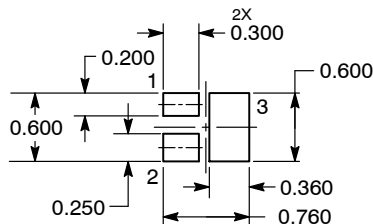


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.  
2. CONTROLLING DIMENSION: MILLIMETERS.

MILLIMETERS		
DIM	MIN	MAX
A	0.340	0.440
A1	0.000	0.030
b	0.100	0.200
b1	0.150	0.250
D	0.620 BSC	
D2	0.175 BSC	
D3	0.205 BSC	
E	0.620 BSC	
E2	0.400	0.600
e	0.200 BSC	
e1	0.175 BSC	
L	0.090	0.210
L2	0.110	0.310



### RECOMMENDED SOLDER FOOTPRINT\*



DIMENSIONS: MILLIMETERS

\*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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