

# NTND31225CZ

## Small Signal MOSFET

20 V, Complementary 0.65 mm x 0.90 mm x 0.4 mm XLLGA6 Package

### Features

- Advanced Trench Complementary MOSFET
- Offers a Low  $R_{DS(ON)}$  Solution in the Ultra Small 0.65 mm x 0.90 mm Package
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

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

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

Parameter		Symbol	Value	Unit	
Drain-to-Source Voltage	NMOS	$V_{DSS}$	20	V	
	PMOS		-20		
Gate-to-Source Voltage	NMOS	$V_{GSS}$	$\pm 8$	V	
	PMOS		$\pm 8$		
N-Channel Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	220	mA
		$T_A = 85^\circ\text{C}$		158	
	$t \leq 5$ s	$T_A = 25^\circ\text{C}$		253	
P-Channel Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	-127	mA
		$T_A = 85^\circ\text{C}$		-91	
	$t \leq 5$ s	$T_A = 25^\circ\text{C}$		-146	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	125	mW
		$t \leq 5$ s		166	
Pulsed Drain Current	NMOS	$t_p = 10 \mu\text{s}$	$I_{DM}$	846	mA
	PMOS			-488	
Source Current (Body Diode)		$I_S$		200	mA
				-200	
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$	
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.

1. Surface-mounted on FR4 board using the minimum recommended pad size, 1 oz Cu.

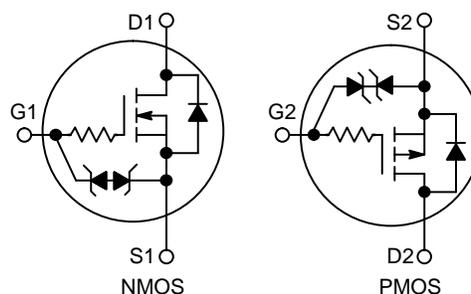


ON Semiconductor®

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$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	$I_D$ Max
N-Channel 20 V	1.5 $\Omega$ @ 4.5 V	220 mA
	2.0 $\Omega$ @ 2.5 V	
	3.0 $\Omega$ @ 1.8 V	
	4.5 $\Omega$ @ 1.5 V	
P-Channel -20 V	5.0 $\Omega$ @ -4.5 V	-127 mA
	6.0 $\Omega$ @ -2.5 V	
	7.0 $\Omega$ @ -1.8 V	
	10.0 $\Omega$ @ -1.5 V	

### DEVICE SYMBOL



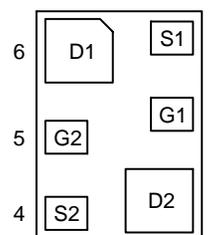
XLLGA6  
Case 713AC

### MARKING DIAGRAM



L = Specific Device Code  
M = Date Code

### PINOUT DIAGRAM



(Bottom View)

### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

# NTND31225CZ

## THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Ambient (Note 2) Steady State $t \leq 5$ s	$R_{\theta JA}$	998 751	$^{\circ}\text{C/W}$

2. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq), 1 oz copper

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

Parameter	Symbol	FET	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	N	$V_{GS} = 0$ V, $I_D = 250$ $\mu\text{A}$	20			V
		P	$V_{GS} = 0$ V, $I_D = -250$ $\mu\text{A}$	-20			
Zero Gate Voltage Drain Current	$I_{DSS}$	N	$V_{GS} = 0$ V, $V_{DS} = 5$ V	$T_J = 25^{\circ}\text{C}$		50	nA
				$T_J = 85^{\circ}\text{C}$		200	
			$V_{GS} = 0$ V, $V_{DS} = 16$ V	$T_J = 25^{\circ}\text{C}$		100	
		P	$V_{GS} = 0$ V, $V_{DS} = -5$ V	$T_J = 25^{\circ}\text{C}$		-50	
				$T_J = 85^{\circ}\text{C}$		-200	
			$V_{GS} = 0$ V, $V_{DS} = -16$ V	$T_J = 25^{\circ}\text{C}$		-100	
Gate-to-Source Leakage Current	$I_{GSS}$	N	$V_{GS} = 0$ V, $V_{DS} = \pm 5$ V			$\pm 100$	nA
		P	$V_{GS} = 0$ V, $V_{DS} = \pm 5$ V			$\pm 100$	

### ON CHARACTERISTICS

Gate Threshold Voltage	$V_{GS(TH)}$	N	$V_{GS} = V_{DS}$ , $I_D = 250$ $\mu\text{A}$	0.4		1.0	V
		P	$V_{GS} = V_{DS}$ , $I_D = -250$ $\mu\text{A}$	-0.4		-1.0	
Drain-to-Source On Resistance	$R_{DS(ON)}$	N	$V_{GS} = 4.5$ V, $I_D = 100$ mA		0.8	1.5	$\Omega$
			$V_{GS} = 2.5$ V, $I_D = 50$ mA		1.1	2.0	
			$V_{GS} = 1.8$ V, $I_D = 20$ mA		1.4	3.0	
			$V_{GS} = 1.5$ V, $I_D = 10$ mA		1.8	4.5	
		P	$V_{GS} = -4.5$ V, $I_D = -100$ mA		2.1	5.0	
			$V_{GS} = -2.5$ V, $I_D = -50$ mA		2.7	6.0	
			$V_{GS} = -1.8$ V, $I_D = -20$ mA		3.6	7.0	
			$V_{GS} = -1.5$ V, $I_D = -10$ mA		4.2	10.0	
Forward Transconductance	$g_{FS}$	N	$V_{DS} = 5$ V, $I_D = 125$ mA		0.48		S
		P	$V_{DS} = -5$ V, $I_D = -125$ mA		0.35		
Forward Diode Voltage	$V_{SD}$	N	$V_{GS} = 0$ V, $I_S = 10$ mA		0.6	1.0	V
		P	$V_{GS} = 0$ V, $I_S = -10$ mA		-0.6	-1.0	

3. Switching characteristics are independent of operating junction temperatures.

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.

# NTND31225CZ

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

Parameter	Symbol	FET	Test Condition	Min	Typ	Max	Unit
<b>CAPACITANCES</b>							
Input Capacitance	$C_{ISS}$	N	$V_{GS} = 0\text{ V}, f = 1\text{ MHz},$ $V_{DS} = 15\text{ V}$		12.3		pF
Output Capacitance	$C_{OSS}$				3.4		
Reverse Capacitance	$C_{RSS}$				2.5		
Input Capacitance	$C_{ISS}$	P	$V_{GS} = 0\text{ V}, f = 1\text{ MHz},$ $V_{DS} = -15\text{ V}$		12.8		
Output Capacitance	$C_{OSS}$				2.8		
Reverse Capacitance	$C_{RSS}$				2.0		

## SWITCHING CHARACTERISTICS, $V_{GS} = 4.5\text{ V}$

Turn-On Delay Time	$t_{d(ON)}$	N	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V},$ $I_D = 200\text{ mA}, R_G = 2\ \Omega$		16.5		ns
Rise Time	$t_r$				25.5		
Turn-Off Delay Time	$t_{d(OFF)}$				142		
Fall Time	$t_f$				80		
Turn-On Delay Time	$t_{d(ON)}$	P	$V_{GS} = -4.5\text{ V}, V_{DS} = -15\text{ V},$ $I_D = -200\text{ mA}, R_G = 2\ \Omega$		37		
Rise Time	$t_r$				71		
Turn-Off Delay Time	$t_{d(OFF)}$				280		
Fall Time	$t_f$				171		

3. Switching characteristics are independent of operating junction temperatures.

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.

## ORDERING INFORMATION

Device	Package	Shipping†
NTND31225CZTAG	XLLGA6 (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.

TYPICAL CHARACTERISTICS – P-CHANNEL

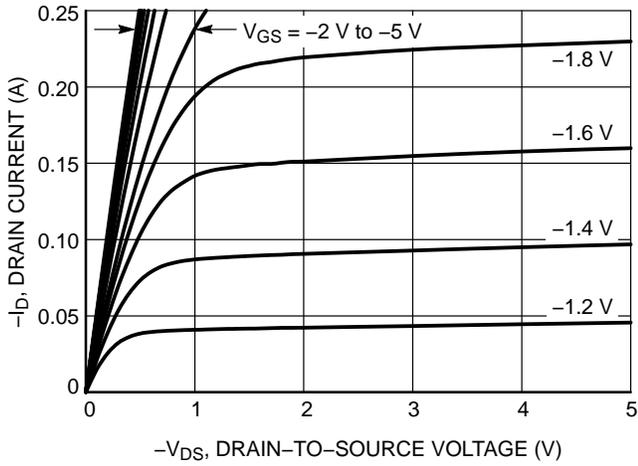


Figure 1. On-Region Characteristics

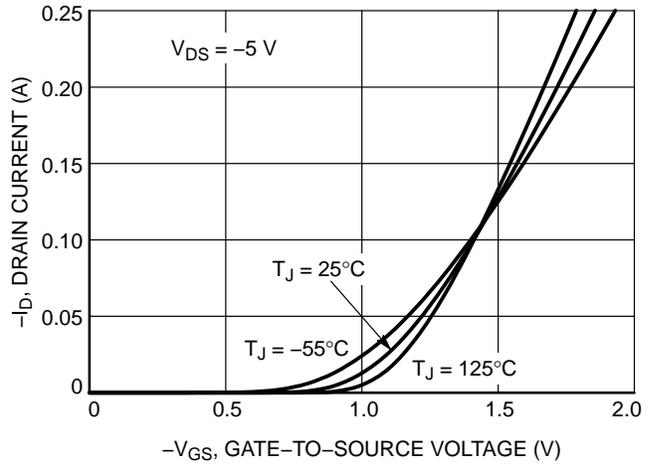


Figure 2. Transfer Characteristics

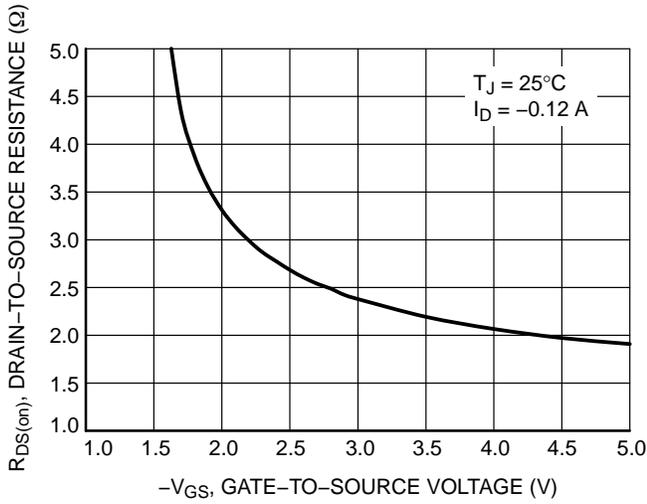


Figure 3. On-Resistance vs. Gate-to-Source Voltage

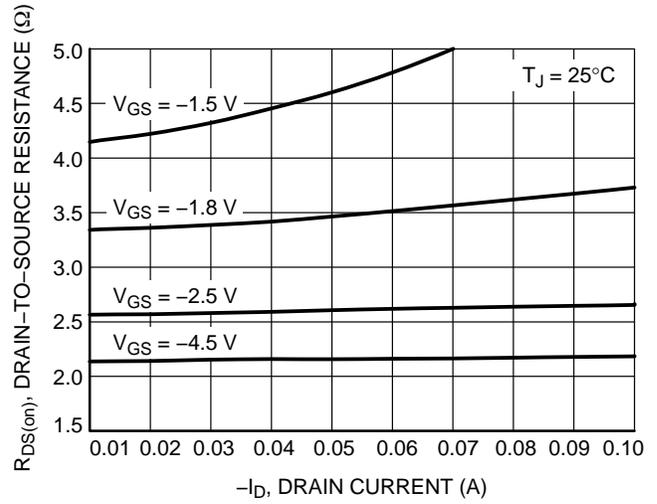


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

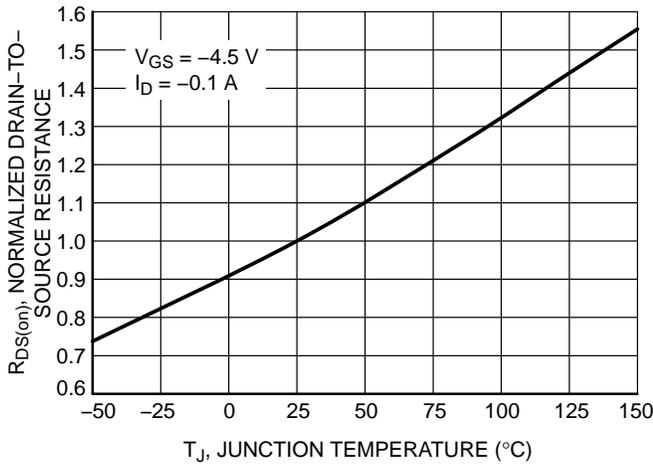


Figure 5. On-Resistance Variation with Temperature

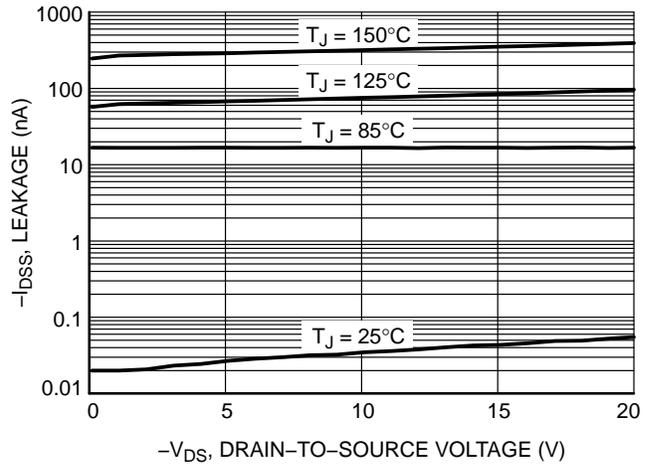


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTND31225CZ

## TYPICAL CHARACTERISTICS – P-CHANNEL

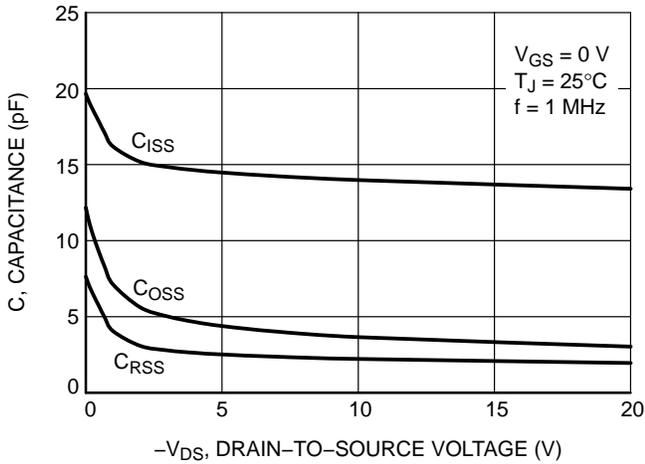


Figure 7. Capacitance Variation

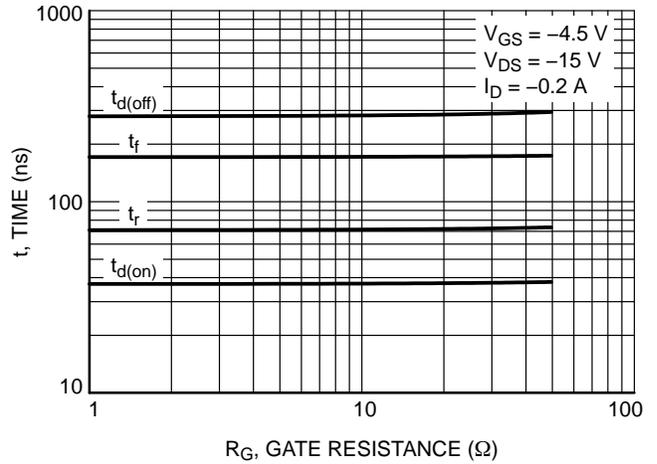


Figure 8. Resistive Switching Time Variation vs. Gate Resistance

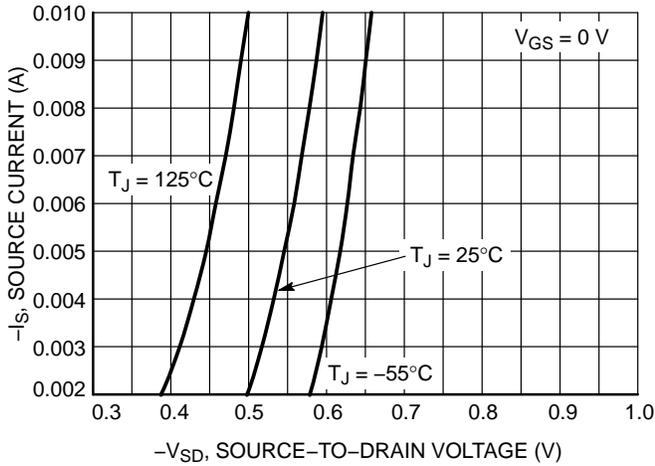


Figure 9. Diode Forward Voltage vs. Current

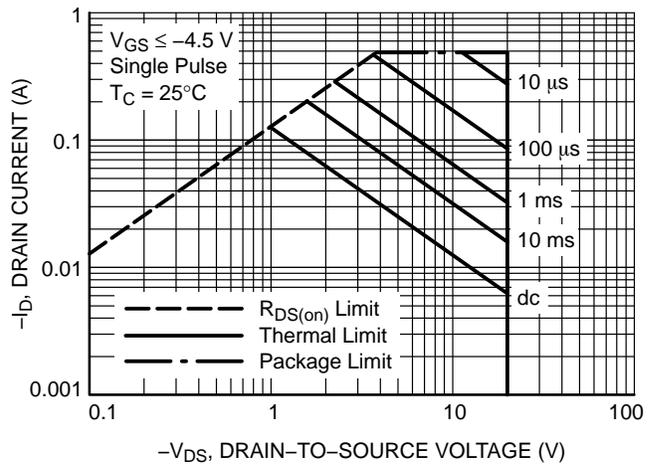


Figure 10. Maximum Rated Forward Biased Safe Operating Area

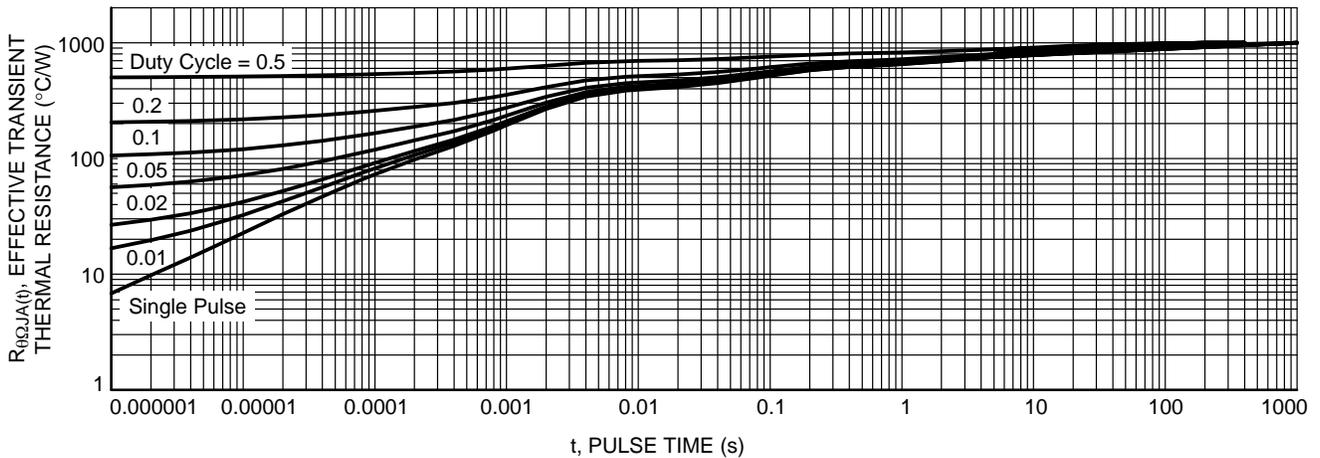


Figure 11. Thermal Response

# NTND31225CZ

## TYPICAL CHARACTERISTICS – N-CANNEL

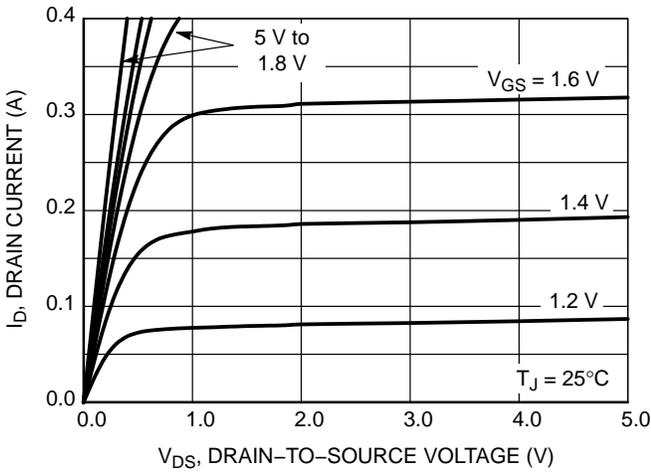


Figure 12. On-Region Characteristics

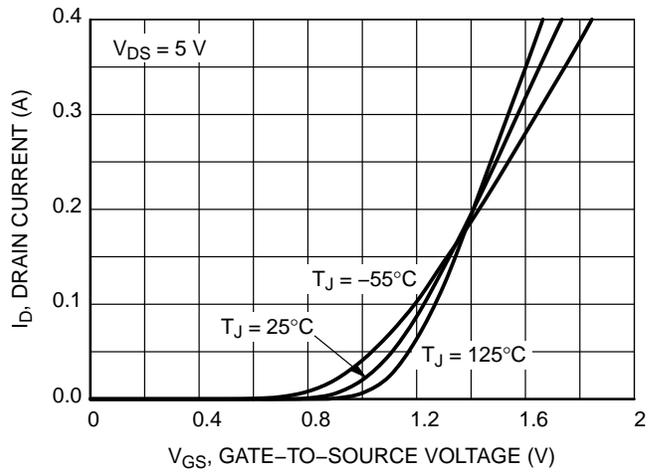


Figure 13. Transfer Characteristics

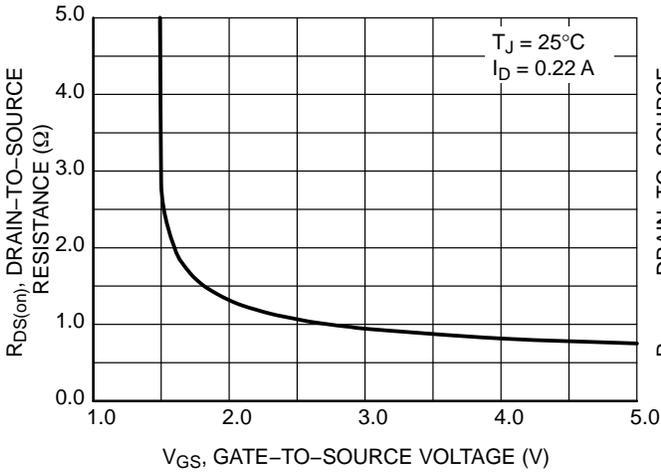


Figure 14. On-Resistance vs. Gate-to-Source Voltage

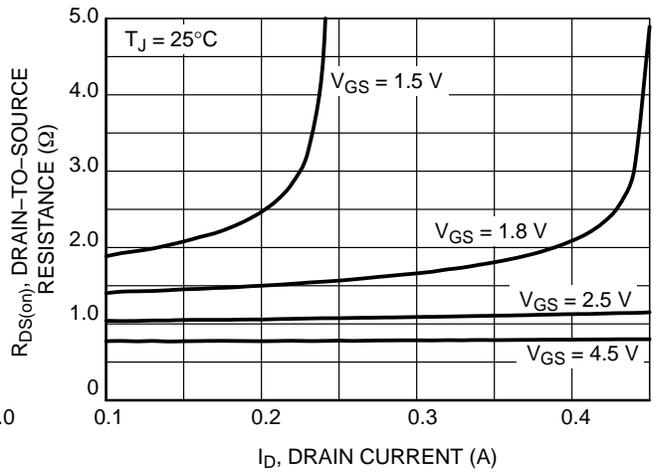


Figure 15. On-Resistance vs. Drain Current and Gate Voltage

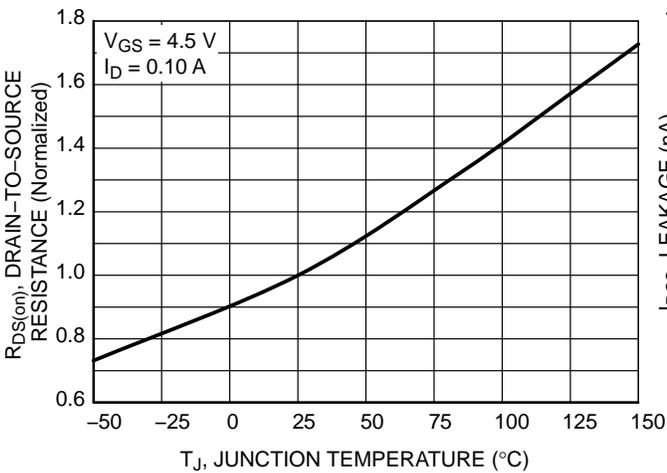


Figure 16. On-Resistance Variation with Temperature

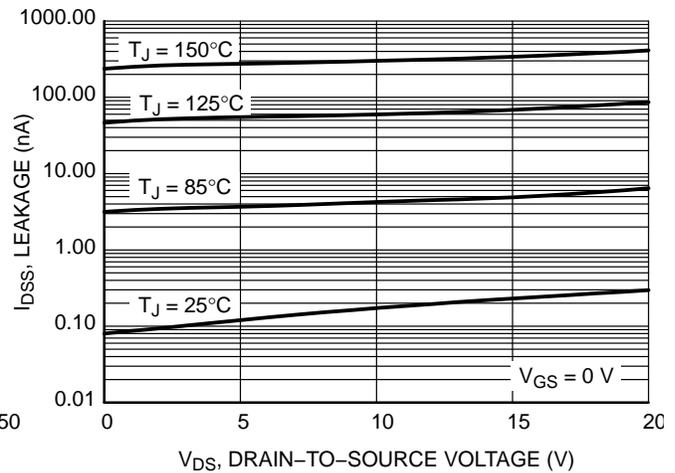


Figure 17. Drain-to-Source Leakage Current vs. Voltage

# NTND31225CZ

## TYPICAL CHARACTERISTICS – N-CANNEL

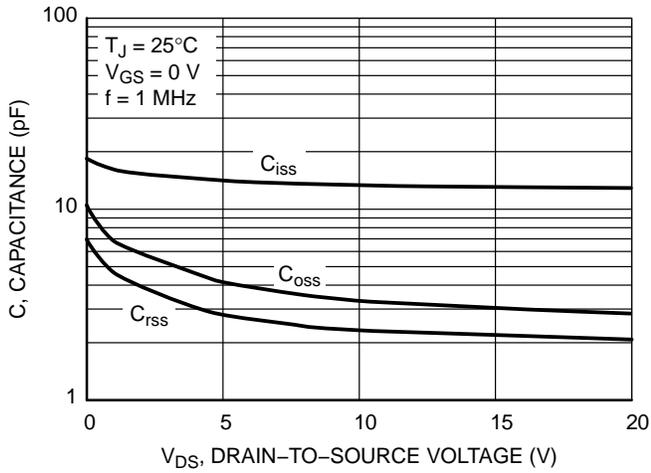


Figure 18. Capacitance Variation

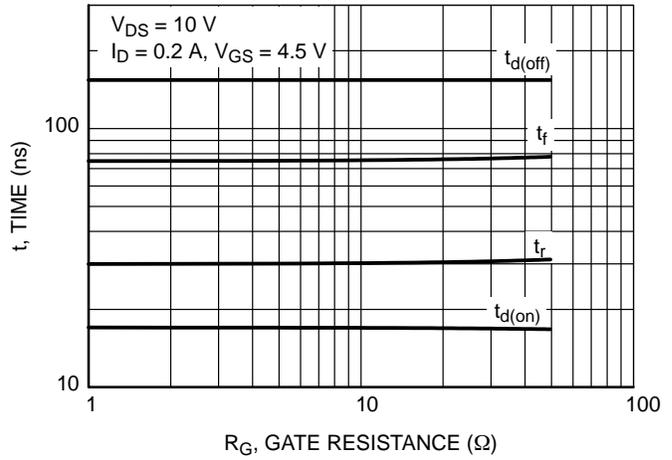


Figure 19. Resistive Switching Time Variation vs. Gate Resistance

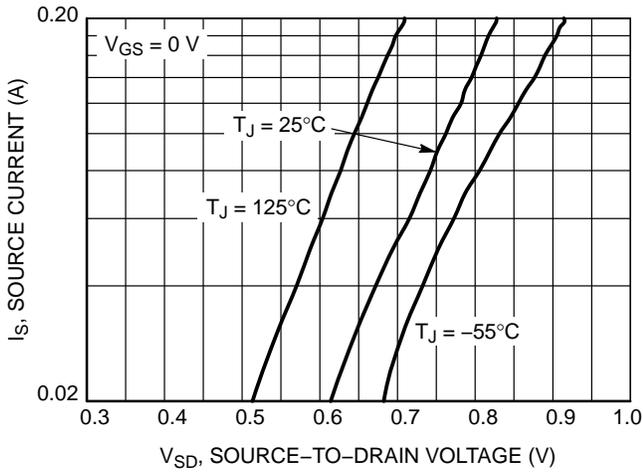


Figure 20. Diode Forward Voltage vs. Current

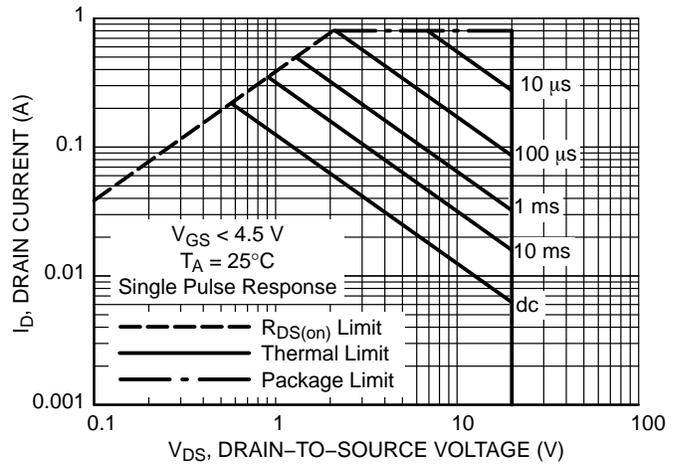


Figure 21. Maximum Rated Forward Biased Safe Operating Area

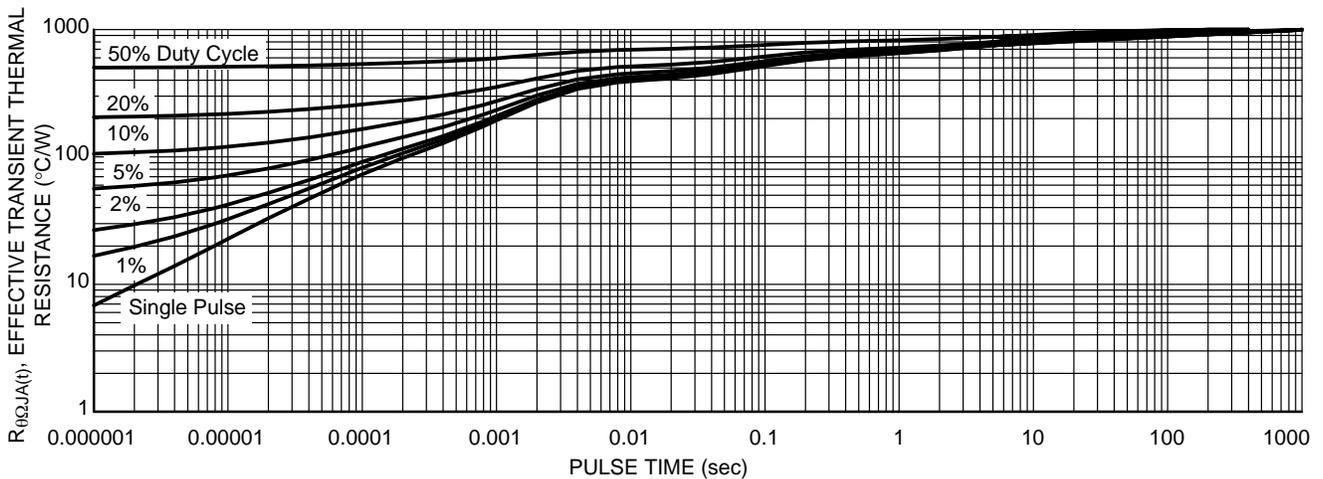
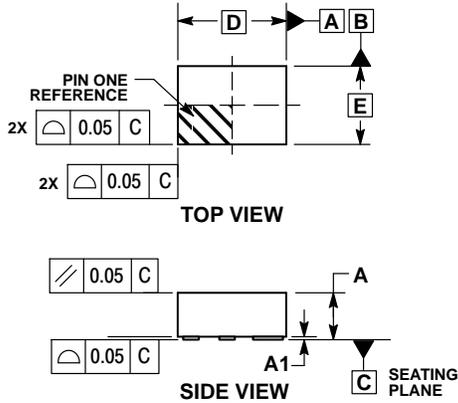


Figure 22. Thermal Response

# NTND31225CZ

## PACKAGE DIMENSIONS

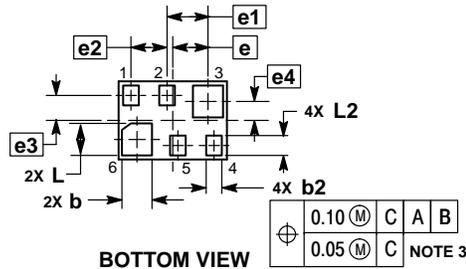
**XLLGA6 0.90x0.65**  
**CASE 713AC**  
**ISSUE O**



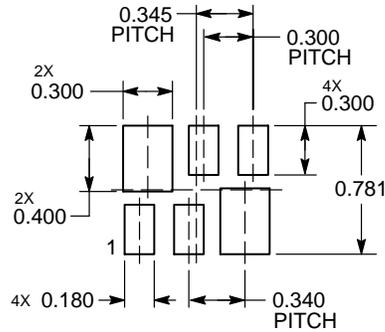
**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. POSITIONAL TOLERANCE APPLIES TO ALL SIX LEADS.

DIM	MILLIMETERS	
	MIN	MAX
A	0.340	0.440
A1	0.000	0.050
b	0.200	0.300
b2	0.080	0.180
D	0.900 BSC	
E	0.650 BSC	
e	0.295 BSC	
e1	0.340 BSC	
e2	0.300 BSC	
e3	0.208 BSC	
e4	0.158 BSC	
L	0.215	0.315
L2	0.115	0.215



**RECOMMENDED SOLDERING FOOTPRINT\***



\*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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