

# NTUD3128N

## Small Signal MOSFET

20 V, 200 mA, Dual N-Channel, 1.0 mm x 1.0 mm SOT-963 Package



ON Semiconductor®

<http://onsemi.com>

### Features

- Dual N-Channel MOSFET
- Offers a Low  $R_{DS(ON)}$  Solution in the Ultra Small 1.0 x 1.0 mm Package
- 1.5 V Gate Voltage Rating
- Ultra Thin Profile (< 0.5 mm) Allows It to Fit Easily into Extremely Thin Environments such as Portable Electronics
- These are Pb-Free Devices

### Applications

- General Purpose Interfacing Switch
- Optimized for Power Management in Ultra Portable Equipment

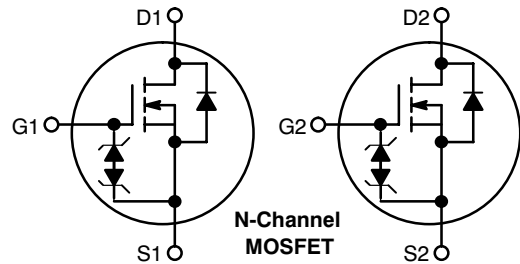
### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		$V_{DSS}$	20	V
Gate-to-Source Voltage		$V_{GS}$	$\pm 8$	V
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	160
				$T_A = 85^\circ\text{C}$
	$t \leq 5 \text{ s}$	$T_A = 25^\circ\text{C}$		200
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	125
				$t \leq 5 \text{ s}$
Pulsed Drain Current		$t_p = 10 \mu\text{s}$	$I_{DM}$	800 mA
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$
Source Current (Body Diode) (Note 2)		$I_S$	200	mA
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$

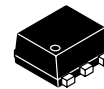
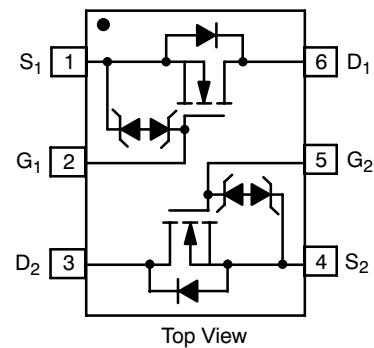
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Surface-mounted on FR4 board using the minimum recommended pad size, 1 oz Cu.
2. Pulse Test: pulse width  $\leq 300 \mu\text{s}$ , duty cycle  $\leq 2\%$

$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	$I_D$ Max
20 V	3.0 $\Omega$ @ 4.5 V	0.2 A
	4.0 $\Omega$ @ 2.5 V	
	6.0 $\Omega$ @ 1.8 V	
	10 $\Omega$ @ 1.5 V	

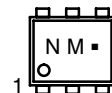


### PINOUT: SOT-963



SOT-963  
CASE 527AA

### MARKING DIAGRAM



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

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

# NTUD3128N

## THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Ambient – Steady State (Note 3)	$R_{\theta JA}$	1000	°C/W
Junction-to-Ambient – $t = 5$ s (Note 3)		600	

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

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	20			V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 5\text{ V}$	$T_J = 25^\circ\text{C}$		50	nA
			$T_J = 85^\circ\text{C}$		200	
		$V_{GS} = 0\text{ V}, V_{DS} = 16\text{ V}$	$T_J = 25^\circ\text{C}$		100	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 5.0\text{ V}$			100	nA

## ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	0.4		1.0	V
Drain-to-Source On Resistance	$R_{DS(ON)}$	$V_{GS} = 4.5\text{ V}, I_D = 100\text{ mA}$		1.5	3.0	$\Omega$
		$V_{GS} = 2.5\text{ V}, I_D = 50\text{ mA}$		2.0	4.0	
		$V_{GS} = 1.8\text{ V}, I_D = 20\text{ mA}$		3.0	6.0	
		$V_{GS} = 1.5\text{ V}, I_D = 10\text{ mA}$		4.0	10	
		$V_{GS} = 1.2\text{ V}, I_D = 1.0\text{ mA}$		5.5		
Forward Transconductance	$g_{FS}$	$V_{DS} = 5.0\text{ V}, I_D = 125\text{ mA}$		0.35		S
Source-Drain Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_D = 10\text{ mA}$		0.6	1.0	V

## CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$f = 1.0\text{ MHz}, V_{GS} = 0\text{ V}$ $V_{DS} = 15\text{ V}$		9.0		pF
Output Capacitance	$C_{OSS}$			3.0		
Reverse Transfer Capacitance	$C_{RSS}$			2.2		

## SWITCHING CHARACTERISTICS, $V_{GS} = 4.5\text{ V}$ (Note 4)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DD} = 10\text{ V}, I_D = 200\text{ mA},$ $R_G = 2.0\ \Omega$		15		ns
Rise Time	$t_r$			24		
Turn-Off Delay Time	$t_{d(OFF)}$			90		
Fall Time	$t_f$			60		

4. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

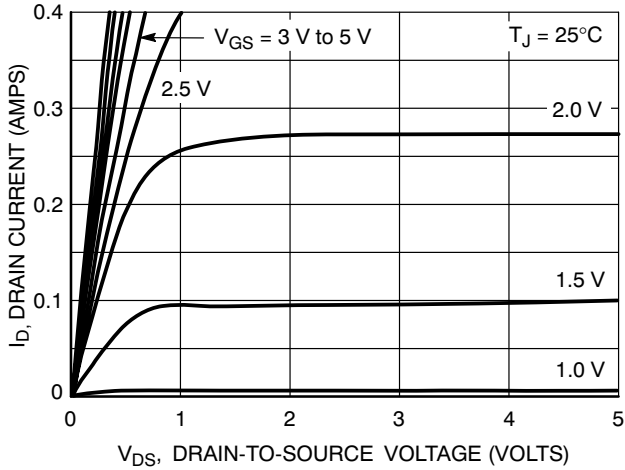


Figure 1. On-Region Characteristics

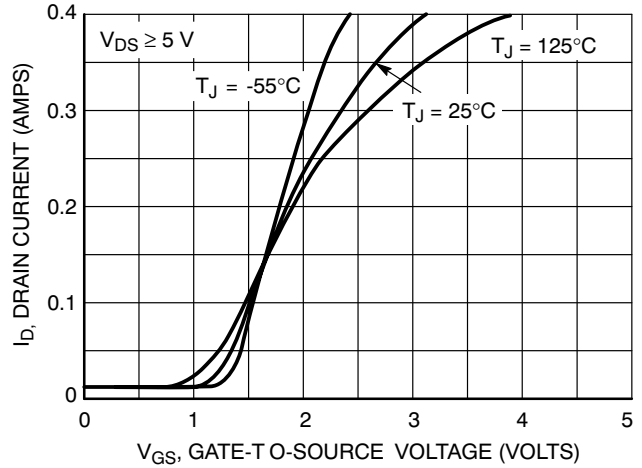


Figure 2. Transfer Characteristics

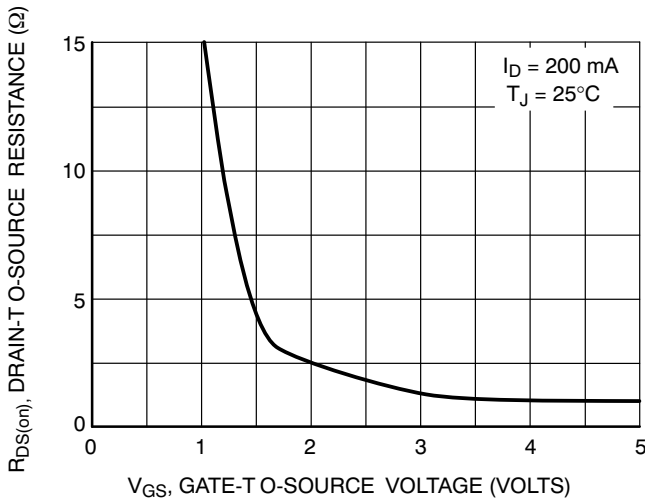


Figure 3. On-Resistance vs. Gate Voltage

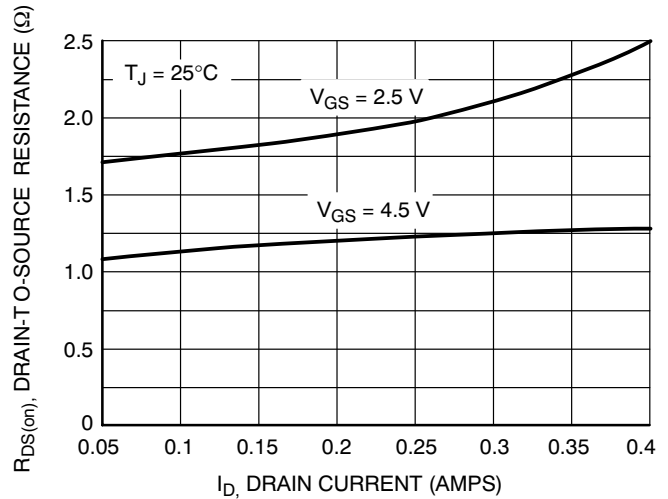


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

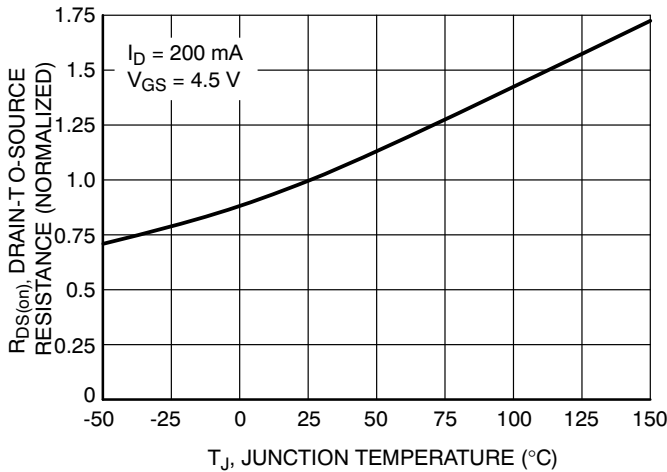


Figure 5. On-Resistance Variation with Temperature

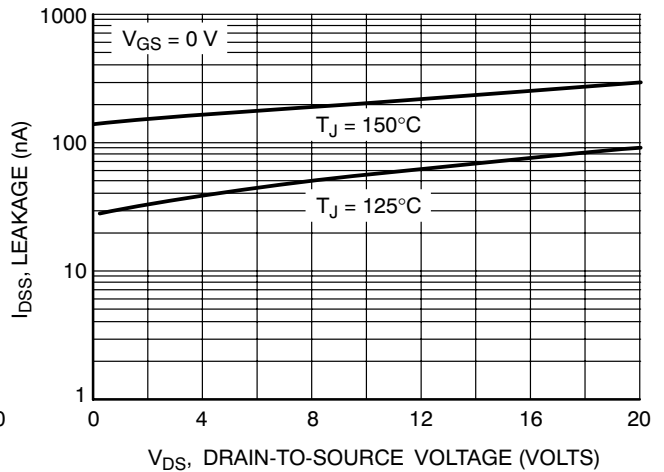


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTUD3128N

## TYPICAL PERFORMANCE CURVES

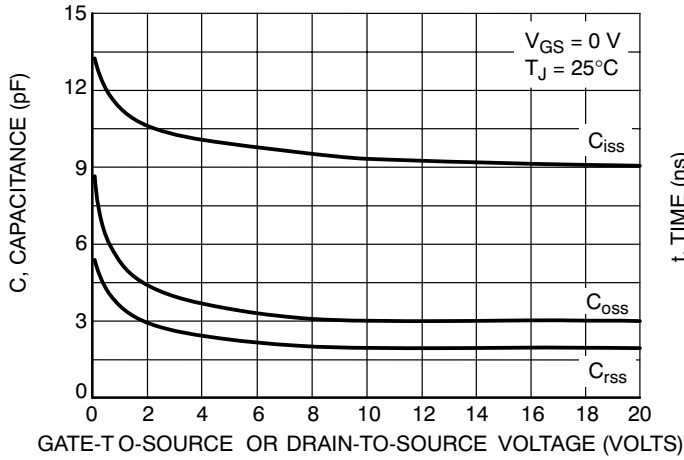


Figure 7. Capacitance Variation

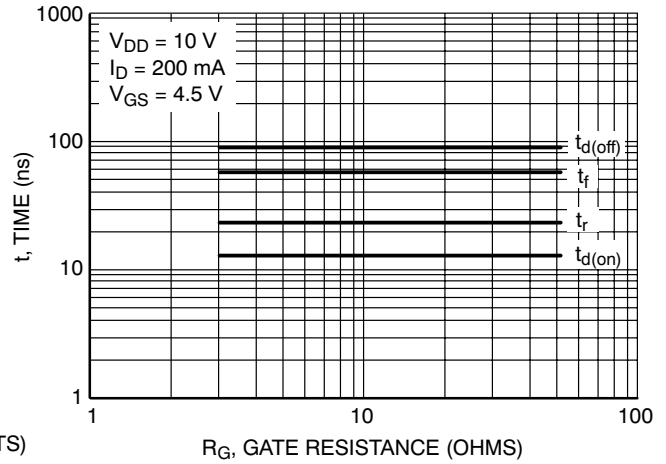


Figure 8. Resistive Switching Time Variation vs. Gate Resistance

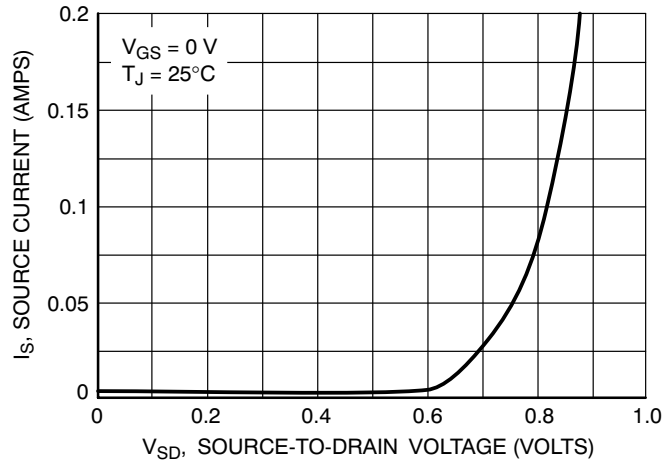


Figure 9. Diode Forward Voltage vs. Current

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
NTUD3128NT5G	SOT-963 (Pb-Free)	8000 / 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.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

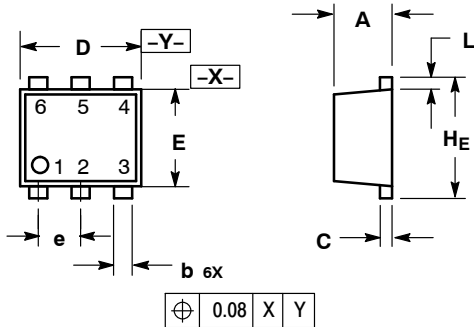
ON Semiconductor®



**SOT-963**  
CASE 527AA-01  
ISSUE D

DATE 30 JUL 2008

  
SCALE 4:1



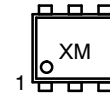
**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.40	0.45	0.50	0.016	0.018	0.020
b	0.10	0.15	0.20	0.004	0.006	0.008
C	0.05	0.10	0.15	0.002	0.004	0.006
D	0.95	1.00	1.05	0.037	0.039	0.041
E	0.75	0.80	0.85	0.03	0.032	0.034
e	0.35 BSC			0.014 BSC		
L	0.05	0.10	0.15	0.002	0.004	0.006
H <sub>E</sub>	0.95	1.00	1.05	0.037	0.039	0.041

- |  |   |  |
|--|---|--|
| <p><b>STYLE 1:</b><br/>PIN 1. EMITTER 1<br/>2. BASE 1<br/>3. COLLECTOR 2<br/>4. EMITTER 2<br/>5. BASE 2<br/>6. COLLECTOR 1</p> | <p><b>STYLE 2:</b><br/>PIN 1. EMITTER 1<br/>2. EMITTER2<br/>3. BASE 2<br/>4. COLLECTOR 2<br/>5. BASE 1<br/>6. COLLECTOR 1</p> | <p><b>STYLE 3:</b><br/>PIN 1. CATHODE 1<br/>2. CATHODE 1<br/>3. ANODE/ANODE 2<br/>4. CATHODE 2<br/>5. CATHODE 2<br/>6. ANODE/ANODE 1</p> |
| <p><b>STYLE 4:</b><br/>PIN 1. COLLECTOR<br/>2. COLLECTOR<br/>3. BASE<br/>4. EMITTER<br/>5. COLLECTOR<br/>6. COLLECTOR</p>      | <p><b>STYLE 5:</b><br/>PIN 1. CATHODE<br/>2. CATHODE<br/>3. ANODE<br/>4. ANODE<br/>5. CATHODE<br/>6. CATHODE</p>              | <p><b>STYLE 6:</b><br/>PIN 1. CATHODE<br/>2. ANODE<br/>3. CATHODE<br/>4. CATHODE<br/>5. CATHODE<br/>6. CATHODE</p>                       |
| <p><b>STYLE 7:</b><br/>PIN 1. CATHODE<br/>2. ANODE<br/>3. CATHODE<br/>4. CATHODE<br/>5. ANODE<br/>6. CATHODE</p>               | <p><b>STYLE 8:</b><br/>PIN 1. DRAIN<br/>2. DRAIN<br/>3. GATE<br/>4. SOURCE<br/>5. DRAIN<br/>6. DRAIN</p>                      | <p><b>STYLE 9:</b><br/>PIN 1. SOURCE 1<br/>2. GATE 1<br/>3. DRAIN 2<br/>4. SOURCE 2<br/>5. GATE 2<br/>6. DRAIN 1</p>                     |
| <p><b>STYLE 10:</b><br/>PIN 1. CATHODE 1<br/>2. N/C<br/>3. CATHODE 2<br/>4. ANODE 2<br/>5. N/C<br/>6. ANODE 1</p>              |   |  |

**GENERIC MARKING DIAGRAM\***

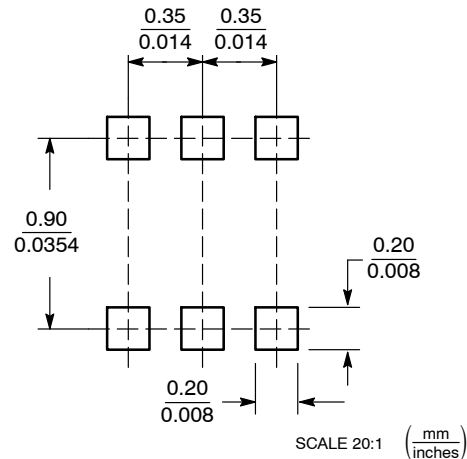


X = Specific Device Code  
M = Month Code

\*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.

**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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<b>DESCRIPTION:</b>	<b>SOT-963, 1X1, 0.35P</b>	<b>PAGE 1 OF 1</b>

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