

# NTUD3170NZ

## MOSFET – Dual, N-Channel, Small Signal, SOT-963, 1.0 mm x 1.0 mm

20 V, 220 mA

### 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
- This is a Pb-Free Device

### Applications

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

### 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        | $T_A = 25^{\circ}\text{C}$    | $I_D$          | 220        | mA                 |
|                                                                   |                     | $T_A = 85^{\circ}\text{C}$    |                | 160        |                    |
|                                                                   | $t \leq 5\text{ s}$ | $T_A = 25^{\circ}\text{C}$    |                | 280        |                    |
| Power Dissipation (Note 1)                                        | Steady State        | $T_A = 25^{\circ}\text{C}$    | $P_D$          | 125        | mW                 |
|                                                                   | $t \leq 5\text{ s}$ |                               |                | 200        |                    |
| Pulsed Drain Current                                              |                     | $t_p = 10\text{ }\mu\text{s}$ | $I_{DM}$       | 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 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.

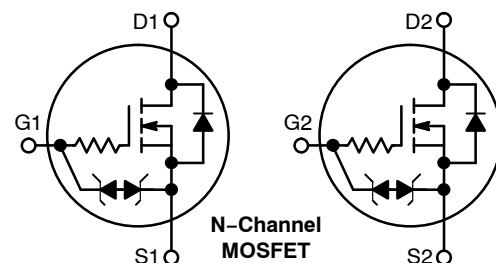
1. Surface-mounted on FR4 board using the minimum recommended pad size, 1 oz Cu.
2. Pulse Test: pulse width  $\leq 300 \mu\text{s}$ , duty cycle  $\leq 2\%$



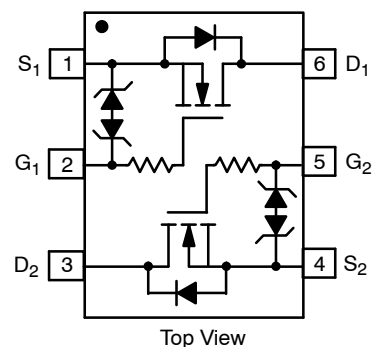
ON Semiconductor®

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| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ MAX}$ | $I_D \text{ Max}$ |
|---------------|--------------------------|-------------------|
| 20 V          | 1.5 $\Omega$ @ 4.5 V     | 0.22 A            |
|               | 2.0 $\Omega$ @ 2.5 V     |                   |
|               | 3.0 $\Omega$ @ 1.8 V     |                   |
|               | 4.5 $\Omega$ @ 1.5 V     |                   |



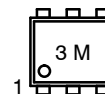
### PINOUT: SOT-963



### MARKING DIAGRAM



SOT-963  
CASE 527AD



3 = Specific Device Code  
M = Date Code

### ORDERING INFORMATION

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

# NTUD3170NZ

## 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 | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 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       | nA   |
|                                   |               | $V_{GS} = 0\text{ V}, V_{DS} = 16\text{ V}$         | $T_J = 25^\circ\text{C}$ |     | 100       |      |
| Gate-to-Source Leakage Current    | $I_{GSS}$     | $V_{DS} = 0\text{ V}, V_{GS} = \pm 5.0\text{ V}$    |                          |     | $\pm 100$ | nA   |

## ON CHARACTERISTICS (Note 4)

|                               |              |                                                 |     |      |     |          |
|-------------------------------|--------------|-------------------------------------------------|-----|------|-----|----------|
| Gate Threshold Voltage        | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$ | 0.4 |      | 1.0 | V        |
| Drain-to-Source On Resistance | $R_{DS(ON)}$ | $V_{GS} = 4.5\text{ V}, I_D = 100\text{ mA}$    |     | 0.75 | 1.5 | $\Omega$ |
|                               |              | $V_{GS} = 2.5\text{ V}, I_D = 50\text{ mA}$     |     | 1.0  | 2.0 |          |
|                               |              | $V_{GS} = 1.8\text{ V}, I_D = 20\text{ mA}$     |     | 1.4  | 3.0 |          |
|                               |              | $V_{GS} = 1.5\text{ V}, I_D = 10\text{ mA}$     |     | 1.8  | 4.5 |          |
|                               |              | $V_{GS} = 1.2\text{ V}, I_D = 1.0\text{ mA}$    |     | 2.8  |     |          |
| Forward Transconductance      | $g_{FS}$     | $V_{DS} = 5.0\text{ V}, I_D = 125\text{ mA}$    |     | 0.48 |     | S        |
| Source-Drain Diode Voltage    | $V_{SD}$     | $V_{GS} = 0\text{ V}, I_S = 10\text{ mA}$       |     | 0.6  | 1.0 | V        |

## CAPACITANCES

|                              |           |                                                                     |  |      |  |    |
|------------------------------|-----------|---------------------------------------------------------------------|--|------|--|----|
| Input Capacitance            | $C_{ISS}$ | $f = 1.0\text{ MHz}, V_{GS} = 0\text{ V}$<br>$V_{DS} = 15\text{ V}$ |  | 12.5 |  | pF |
| Output Capacitance           | $C_{OSS}$ |                                                                     |  | 3.6  |  |    |
| Reverse Transfer Capacitance | $C_{RSS}$ |                                                                     |  | 2.6  |  |    |

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

|                     |              |                                                                                                  |  |      |  |    |
|---------------------|--------------|--------------------------------------------------------------------------------------------------|--|------|--|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = 4.5\text{ V}, V_{DD} = 10\text{ V}, I_D = 200\text{ mA},$<br>$R_G = 2.0\text{ }\Omega$ |  | 16.5 |  | ns |
| Rise Time           | $t_r$        |                                                                                                  |  | 25.5 |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |                                                                                                  |  | 142  |  |    |
| Fall Time           | $t_f$        |                                                                                                  |  | 80   |  |    |

4. Switching characteristics are independent of operating junction temperatures.

## ORDERING INFORMATION

| Device        | Package              | Shipping†          |
|---------------|----------------------|--------------------|
| NTUD3170NZT5G | SOT-963<br>(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

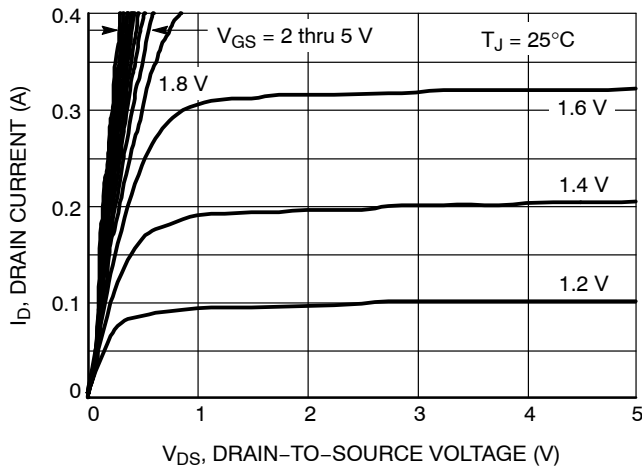


Figure 1. On-Region Characteristics

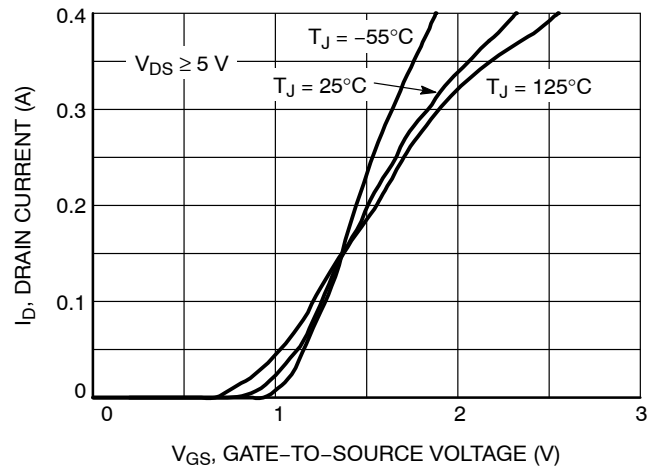


Figure 2. Transfer Characteristics

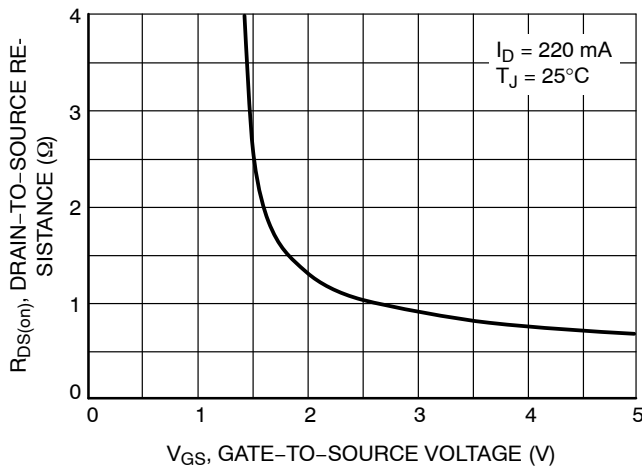


Figure 3. On-Resistance vs. Gate Voltage

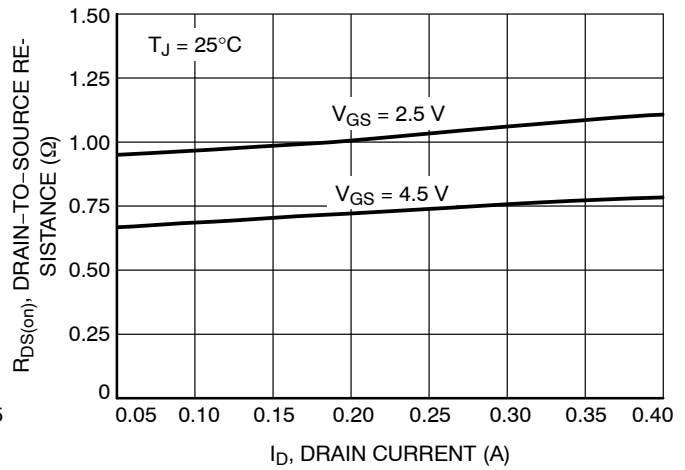


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

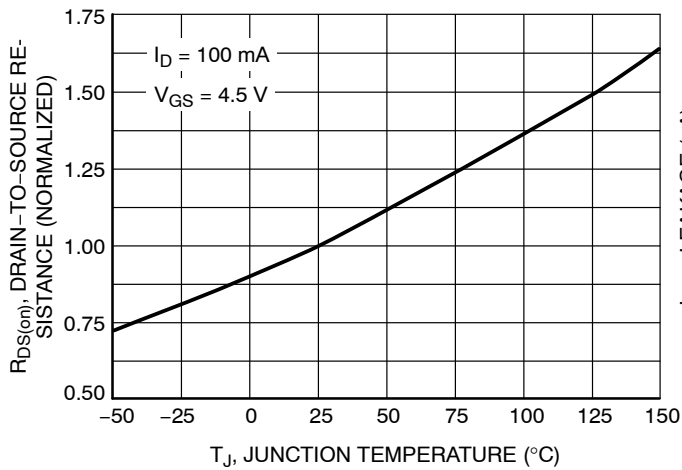


Figure 5. On-Resistance Variation with Temperature

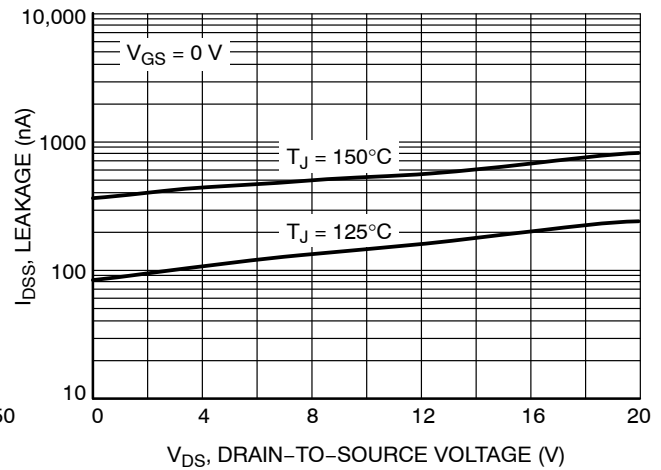


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

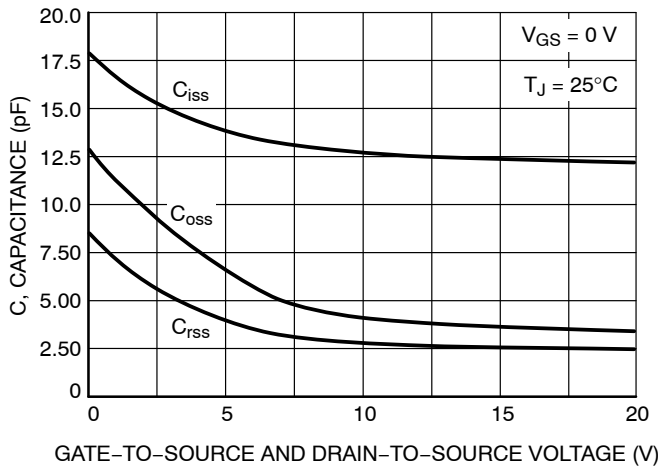


Figure 7. Capacitance Variation

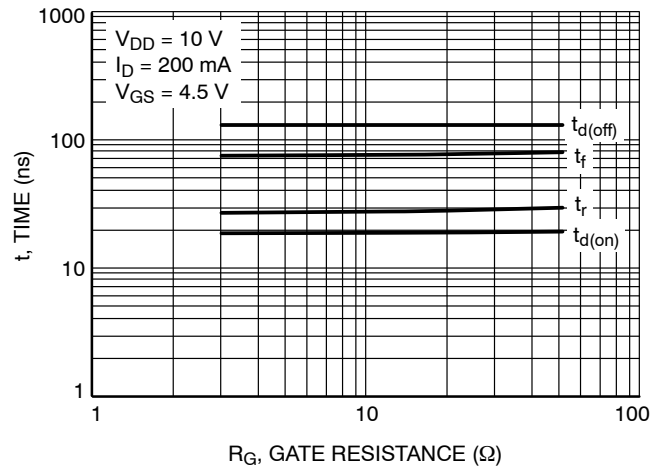


Figure 8. Resistive Switching Time Variation vs. Gate Resistance

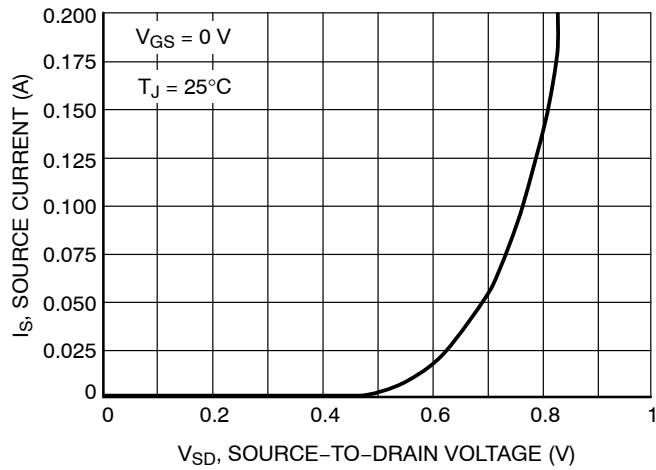
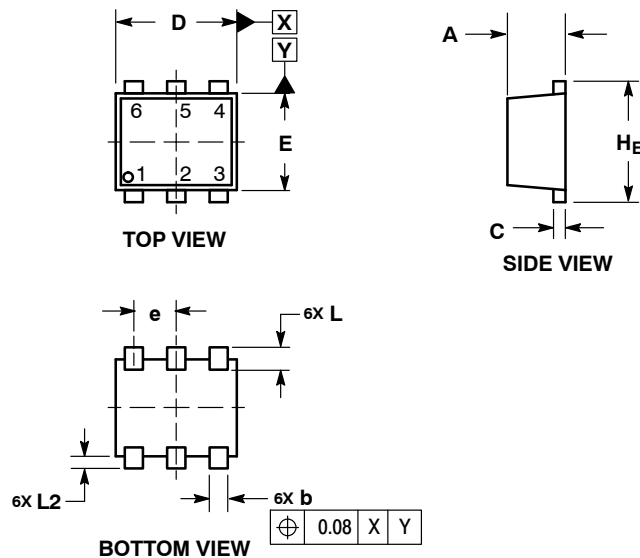


Figure 9. Diode Forward Voltage vs. Current

# NTUD3170NZ

## PACKAGE DIMENSIONS

**SOT-963**  
CASE 527AD  
ISSUE E

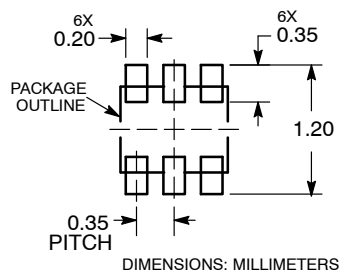


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| MILLIMETERS    |          |      |      |
|----------------|----------|------|------|
| DIM            | MIN      | NOM  | MAX  |
| A              | 0.34     | 0.37 | 0.40 |
| b              | 0.10     | 0.15 | 0.20 |
| C              | 0.07     | 0.12 | 0.17 |
| D              | 0.95     | 1.00 | 1.05 |
| E              | 0.75     | 0.80 | 0.85 |
| e              | 0.35 BSC |      |      |
| H <sub>E</sub> | 0.95     | 1.00 | 1.05 |
| L              | 0.19 REF |      |      |
| L <sub>2</sub> | 0.05     | 0.10 | 0.15 |

### RECOMMENDED MOUNTING FOOTPRINT



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