

# NTZS3151P

## MOSFET – P-Channel, Small Signal, SOT-563

**-20 V, -950 mA**

### Features

- Low  $R_{DS(on)}$  Improving System Efficiency
- Low Threshold Voltage
- Small Footprint 1.6 x 1.6 mm
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

- Load/Power Switches
- Battery Management
- Cell Phones, Digital Cameras, PDAs, Pagers, etc.

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

| Parameter   | Symbol                 | Value                    | Unit |                  |
|---|------------------------|--------------------------|------|------------------|
| Drain-to-Source Voltage   | $V_{DSS}$              | -20                      | V    |                  |
| Gate-to-Source Voltage  | $V_{GS}$               | $\pm 8.0$                | V    |                  |
| Continuous Drain Current (Note 1)                                 | Steady State           | $T_A = 25^\circ\text{C}$ | -860 | mA               |
|   |                        | $T_A = 70^\circ\text{C}$ | -690 |                  |
| Power Dissipation (Note 1)  | Steady State           | $P_D$                    | 170  | mW               |
| Continuous Drain Current (Note 1)                                 | $t \leq 5 \text{ s}$   | $T_A = 25^\circ\text{C}$ | -950 | mA               |
|   |                        | $T_A = 70^\circ\text{C}$ | -760 |                  |
| Power Dissipation (Note 1)  | $t \leq 5 \text{ s}$   | $P_D$                    | 210  | mW               |
| Pulsed Drain Current  | $t_p = 10 \mu\text{s}$ | $I_{DM}$                 | -4.0 | A                |
| Operating Junction and Storage Temperature                        | $T_J, T_{STG}$         | -55 to 150               |      | $^\circ\text{C}$ |
| Source Current (Body Diode)                                       | $I_S$                  | -360                     |      | mA               |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | $T_L$                  | 260                      |      | $^\circ\text{C}$ |

### THERMAL RESISTANCE RATINGS

| Parameter   | Symbol          | Max | Unit                      |
|---|-----------------|-----|---------------------------|
| Junction-to-Ambient – Steady State (Note 1)         | $R_{\theta JA}$ | 720 | $^\circ\text{C}/\text{W}$ |
| Junction-to-Ambient – $t \leq 5 \text{ s}$ (Note 1) | $R_{\theta JA}$ | 600 |                           |

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. [1 oz.] including traces).

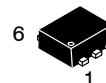
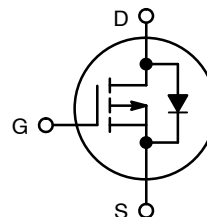


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| $V_{(BR)DSS}$ | $R_{DS(on)}$ Typ        | $I_D$ Max |
|---------------|-------------------------|-----------|
| -20 V         | 120 m $\Omega$ @ -4.5 V | -950 mA   |
|               | 144 m $\Omega$ @ -2.5 V |           |
|               | 195 m $\Omega$ @ -1.8 V |           |

### P-Channel MOSFET



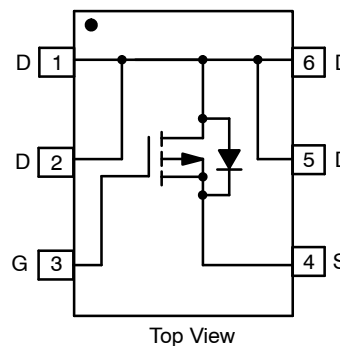
**SOT-563-6  
CASE 463A**

### MARKING DIAGRAM



TX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package  
(Note: Microdot may be in either location)

### PINOUT: SOT-563



### ORDERING INFORMATION

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

# NTZS3151P

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

| 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             |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ |  |     | -13 |           | mV/°C         |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | $V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$    |     |     | -1.0      | $\mu\text{A}$ |
|   |                   | $V_{DS} = -20\text{ V}, T_J = 125^\circ\text{C}$ |     |     | -5.0      |               |
| Gate-to-Source Leakage Current                            | $I_{GSS}$         | $V_{DS} = 0\text{ V}, V_{GS} = \pm 8.0\text{ V}$ |     |     | $\pm 100$ | nA            |

## ON CHARACTERISTICS (Note 2)

|  |                  |  |       |     |      |            |
|--|------------------|--|-------|-----|------|------------|
| Gate Threshold Voltage                     | $V_{GS(TH)}$     | $V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$     | -0.45 |     | -1.0 | V          |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ |  |       | 2.4 |      | mV/°C      |
| Drain-to-Source On Resistance              | $R_{DS(on)}$     | $V_{GS} = -4.5\text{ V}, I_D = -950\text{ mA}$ |       | 120 | 150  | m $\Omega$ |
|  |                  | $V_{GS} = -4.5\text{ V}, I_D = -770\text{ mA}$ |       | 112 | 142  |            |
|  |                  | $V_{GS} = -2.5\text{ V}, I_D = -670\text{ mA}$ |       | 144 | 200  |            |
|  |                  | $V_{GS} = -1.8\text{ V}, I_D = -200\text{ mA}$ |       | 195 | 240  |            |
| Forward Transconductance                   | $g_{FS}$         | $V_{DS} = -10\text{ V}, I_D = -810\text{ mA}$  |       | 3.1 |      | S          |

## CHARGES AND CAPACITANCES

|                              |              |   |  |     |  |    |
|------------------------------|--------------|---|--|-----|--|----|
| Input Capacitance            | $C_{ISS}$    | $V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = -16\text{ V}$      |  | 458 |  | pF |
| Output Capacitance           | $C_{OSS}$    |   |  | 61  |  |    |
| Reverse Transfer Capacitance | $C_{RSS}$    |   |  | 38  |  |    |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = -4.5\text{ V}, V_{DS} = -10\text{ V}; I_D = -770\text{ mA}$ |  | 5.6 |  | nC |
| Threshold Gate Charge        | $Q_{G(TH)}$  |   |  | 0.6 |  |    |
| Gate-to-Source Charge        | $Q_{GS}$     |   |  | 0.9 |  |    |
| Gate-to-Drain Charge         | $Q_{GD}$     |   |  | 1.2 |  |    |

## SWITCHING CHARACTERISTICS (Note 3)

|                     |              |  |  |      |  |    |
|---------------------|--------------|--|--|------|--|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = -4.5\text{ V}, V_{DD} = -10\text{ V}, I_D = -950\text{ mA}, R_G = 6.0\ \Omega$ |  | 5.0  |  | ns |
| Rise Time           | $t_r$        |  |  | 12   |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |  |  | 23.7 |  |    |
| Fall Time           | $t_f$        |  |  | 18   |  |    |

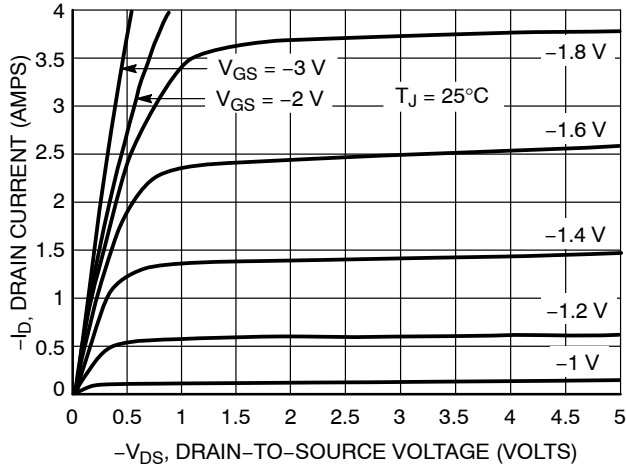
## DRAIN-SOURCE DIODE CHARACTERISTICS

|                       |          |   |                           |      |       |      |    |
|-----------------------|----------|---|---------------------------|------|-------|------|----|
| Forward Diode Voltage | $V_{SD}$ | $V_{GS} = 0\text{ V}, I_S = -360\text{ mA}$                                     | $T_J = 25^\circ\text{C}$  |      | -0.64 | -0.9 | V  |
|                       |          |   | $T_J = 125^\circ\text{C}$ |      | -0.5  |      |    |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s}, I_S = -360\text{ mA}$ |                           | 10.5 |       |      | ns |

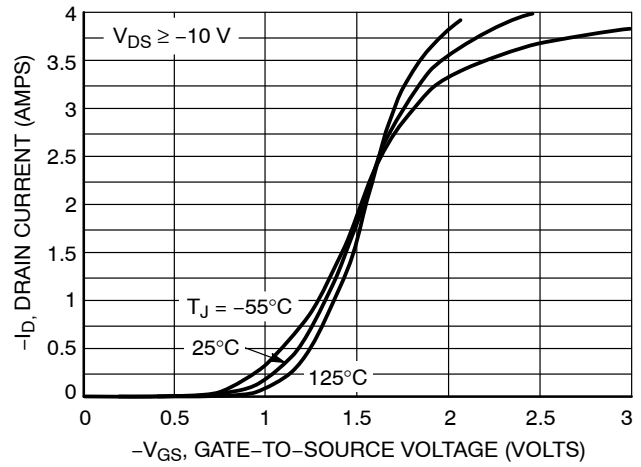
- Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Switching characteristics are independent of operating junction temperatures.

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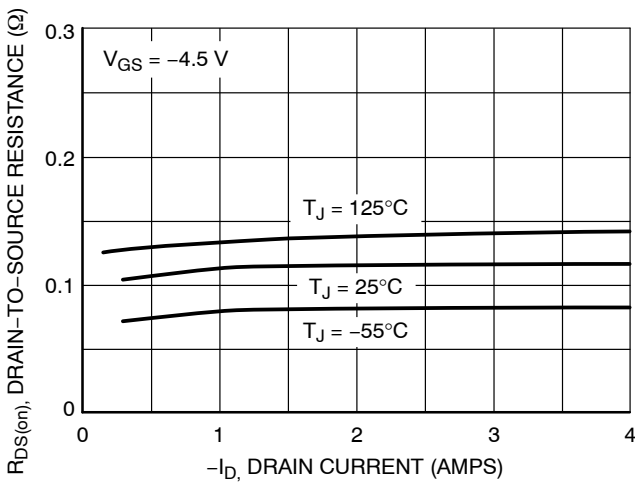
## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)



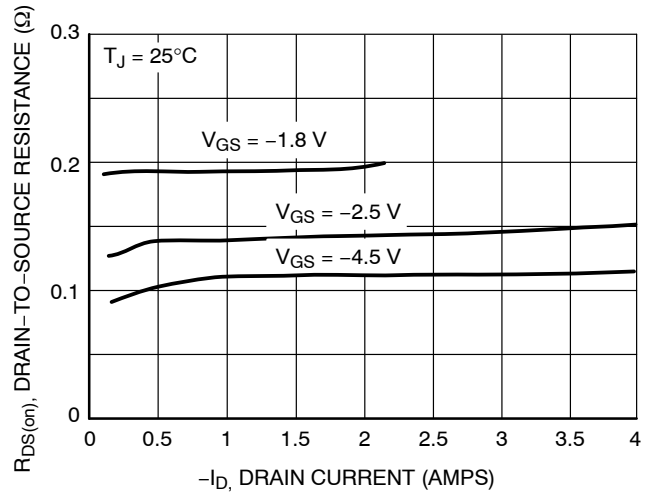
**Figure 1. On-Region Characteristics**



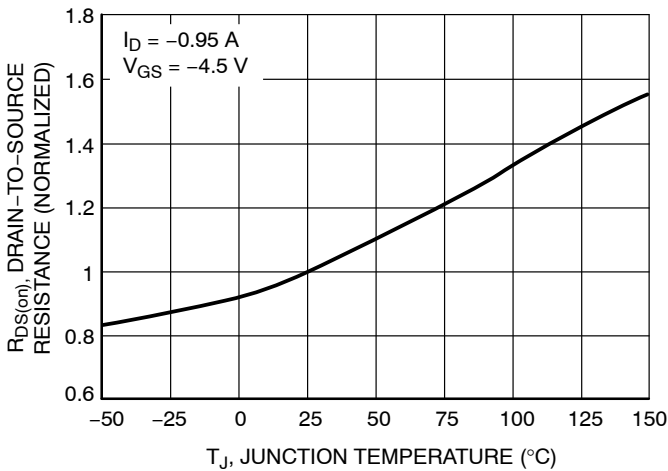
**Figure 2. Transfer Characteristics**



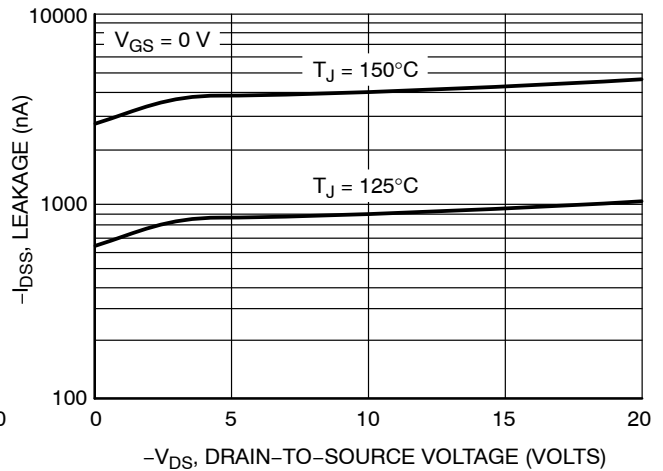
**Figure 3. On-Resistance vs. Drain Current and Temperature**



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



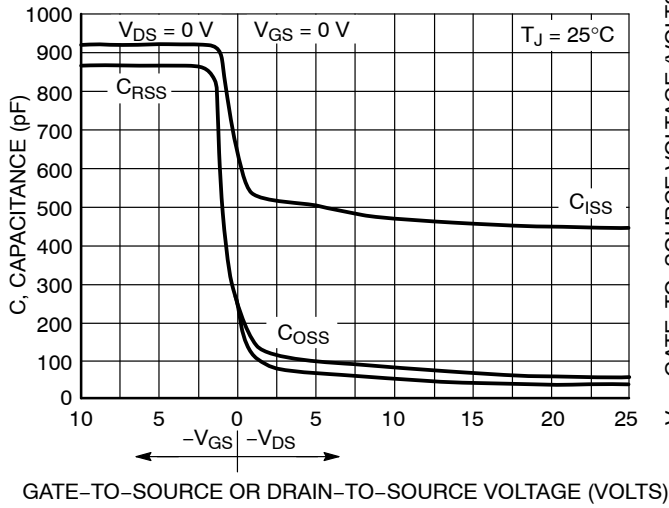
**Figure 5. On-Resistance Variation with Temperature**



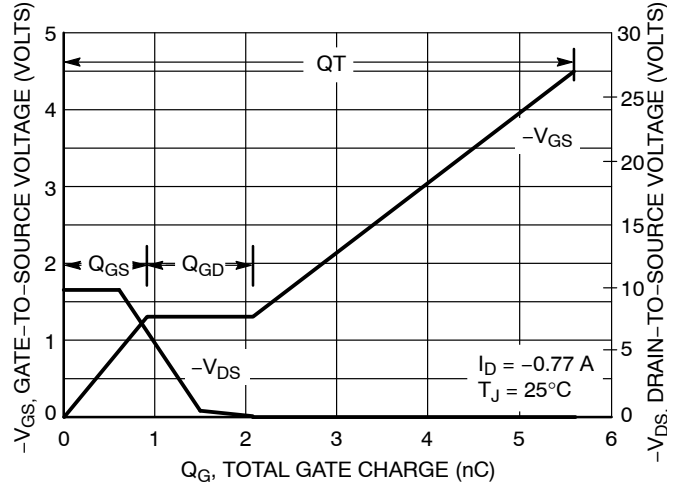
**Figure 6. Drain-to-Source Leakage Current vs. Voltage**

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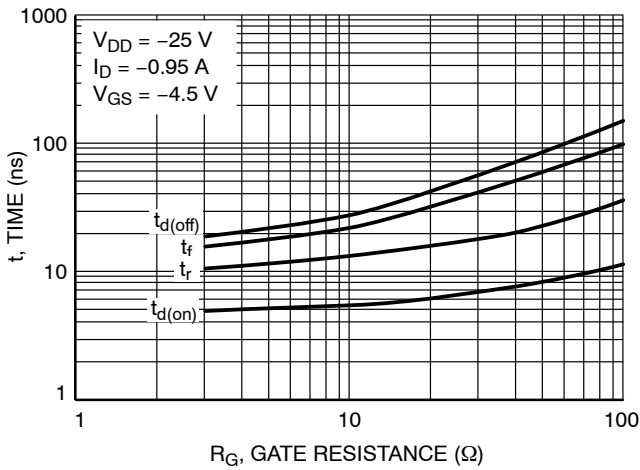
## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)



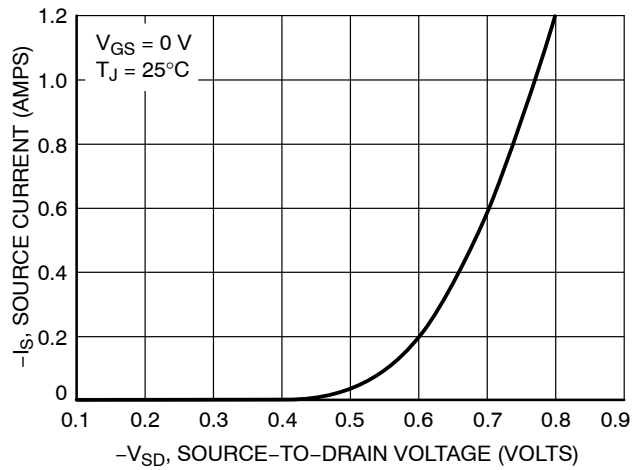
**Figure 7. Capacitance Variation**



**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**

### ORDERING INFORMATION

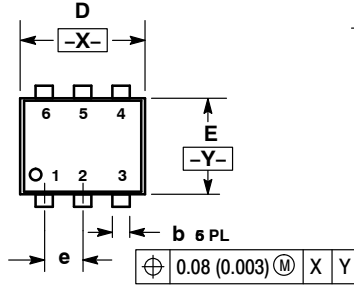
| Device       | Package              | Shipping           |
|--------------|----------------------|--------------------|
| NTZS3151PT1G | SOT-563<br>(Pb-Free) | 4000 / Tape & Reel |
| NTZS3151PT1H | SOT-563<br>(Pb-Free) | 4000 / Tape & Reel |
| NTZS3151PT5G | SOT-563<br>(Pb-Free) | 8000 / Tape & Reel |

†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.

# NTZS3151P

## PACKAGE DIMENSIONS

### SOT-563, 6 LEAD CASE 463A ISSUE F

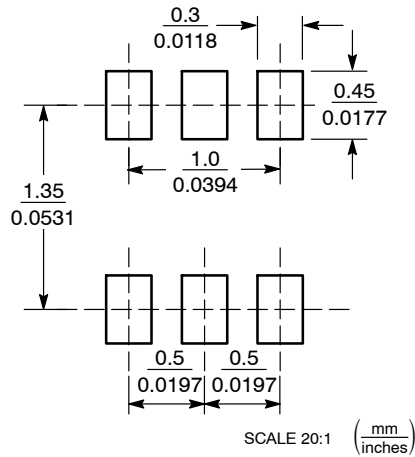


#### NOTES:


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   | 0.50        | 0.55 | 0.60 | 0.020    | 0.021 | 0.023 |
| b   | 0.17        | 0.22 | 0.27 | 0.007    | 0.009 | 0.011 |
| C   | 0.08        | 0.12 | 0.18 | 0.003    | 0.005 | 0.007 |
| D   | 1.50        | 1.60 | 1.70 | 0.059    | 0.062 | 0.066 |
| E   | 1.10        | 1.20 | 1.30 | 0.043    | 0.047 | 0.051 |
| e   | 0.5 BSC     |      |      | 0.02 BSC |       |       |
| L   | 0.10        | 0.20 | 0.30 | 0.004    | 0.008 | 0.012 |
| HE  | 1.50        | 1.60 | 1.70 | 0.059    | 0.062 | 0.066 |

### 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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