

# NTZD5110N

## Small Signal MOSFET 60 V, 310 mA, Dual N-Channel with ESD Protection, SOT-563

### Features

- Low  $R_{DS(on)}$  Improving System Efficiency
- Low Threshold Voltage
- ESD Protected Gate
- Small Footprint 1.6 x 1.6 mm
- These are Pb-Free Devices

### Applications

- Load/Power Switches
- Driver Circuits: Relays, Lamps, Displays, Memories, etc.
- Battery Management/Battery Operated Systems
- 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   |                        | $V_{DSS}$      | 60                       | V                |    |
| Gate-to-Source Voltage  |                        | $V_{GS}$       | $\pm 20$                 | V                |    |
| Continuous Drain Current (Note 1)                                 | Steady State           | $I_D$          | $T_A = 25^\circ\text{C}$ | 294              | mA |
|   |                        |                | $T_A = 85^\circ\text{C}$ |                  |    |
| Power Dissipation (Note 1)  | Steady State           | $P_D$          | 250                      | mW               |    |
| Continuous Drain Current (Note 1)                                 | $t \leq 5$ s           | $I_D$          | $T_A = 25^\circ\text{C}$ | 310              | mA |
|   |                        |                | $T_A = 85^\circ\text{C}$ | 225              |    |
| Power Dissipation (Note 1)  | $t \leq 5$ s           | $P_D$          | 280                      | mW               |    |
| Pulsed Drain Current  | $t_p = 10 \mu\text{s}$ | $I_{DM}$       | 590                      | mA               |    |
| Operating Junction and Storage Temperature                        |                        | $T_J, T_{STG}$ | -55 to 150               | $^\circ\text{C}$ |    |
| Source Current (Body Diode)                                       |                        | $I_S$          | 350                      | mA               |    |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) |                        | $T_L$          | 260                      | $^\circ\text{C}$ |    |
| Gate-Source ESD Rating (HBM, Method 3015)                         |                        | ESD            | 1800                     | V                |    |

### THERMAL RESISTANCE RATINGS

| Parameter                                   | Symbol          | Max | Unit                      |
|---|-----------------|-----|---------------------------|
| Junction-to-Ambient – Steady State (Note 1) | $R_{\theta JA}$ | 500 | $^\circ\text{C}/\text{W}$ |
| Junction-to-Ambient – $t \leq 5$ s (Note 1) |                 | 447 |                           |

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.

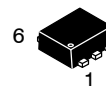
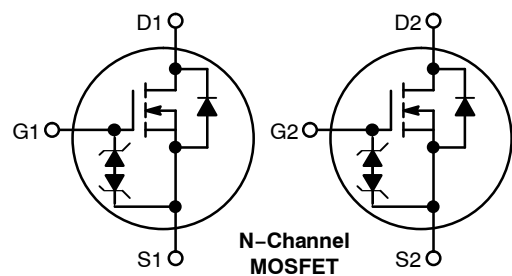
1. Surface mounted on FR4 board using 1 in sq pad size (Cu. area = 1.127 in sq [1 oz] including traces).



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<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX     | $I_D$ Max |
|---------------|----------------------|-----------|
| 60            | 1.6 $\Omega$ @ 10 V  | 310 mA    |
|               | 2.5 $\Omega$ @ 4.5 V |           |



SOT-563  
CASE 463A

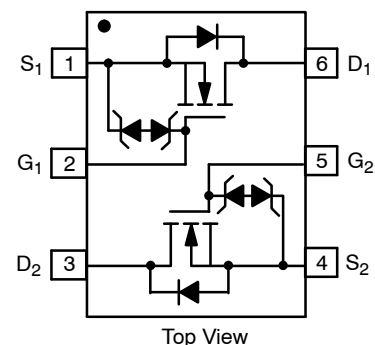
### MARKING DIAGRAM



S7 = Specific Device Code  
M = Date Code

(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.

# NTZD5110N

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted.)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|-----------|--------|----------------|-----|-----|-----|------|
|-----------|--------|----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|   |                                      |   |                        |    |     |       |    |
|---|--------------------------------------|---|------------------------|----|-----|-------|----|
| Drain-to-Source Breakdown Voltage                         | V <sub>(BR)DSS</sub>                 | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA  | 60                     | -  | -   | V     |    |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V <sub>(BR)DSS</sub> /T <sub>J</sub> | -   | -                      | 71 | -   | mV/°C |    |
| Zero Gate Voltage Drain Current                           | I <sub>DSS</sub>                     | V <sub>GS</sub> = 0 V<br>V <sub>DS</sub> = 60 V | T <sub>J</sub> = 25°C  | -  | -   | 1.0   | μA |
|   |                                      |   | T <sub>J</sub> = 125°C | -  | -   | 500   |    |
|   |                                      | V <sub>GS</sub> = 0 V<br>V <sub>DS</sub> = 50 V | T <sub>J</sub> = 25°C  | -  | -   | 100   | nA |
| Gate-to-Source Leakage Current                            | I <sub>GSS</sub>                     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V  | -                      | -  | ±10 | μA    |    |
|   |                                      | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±10 V  | -                      | -  | 450 | nA    |    |
|   |                                      | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±5.0 V | -                      | -  | 150 | nA    |    |

### ON CHARACTERISTICS (Note 3)

|  |                                     |   |     |      |     |       |
|--|-------------------------------------|---|-----|------|-----|-------|
| Gate Threshold Voltage                     | V <sub>GS(TH)</sub>                 | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA | 1.0 | -    | 2.5 | V     |
| Negative Threshold Temperature Coefficient | V <sub>GS(TH)</sub> /T <sub>J</sub> | -   | -   | 4.0  | -   | mV/°C |
| Drain-to-Source On Resistance              | R <sub>DS(on)</sub>                 | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 500 mA             | -   | 1.19 | 1.6 | Ω     |
|  |                                     | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 200 mA            | -   | 1.33 | 2.5 |       |
| Forward Transconductance                   | g <sub>FS</sub>                     | V <sub>DS</sub> = 5.0 V, I <sub>D</sub> = 200 mA            | -   | 80   | -   | S     |

### CHARGES AND CAPACITANCES

|                              |                     |   |   |      |   |    |
|------------------------------|---------------------|---|---|------|---|----|
| Input Capacitance            | C <sub>ISS</sub>    | V <sub>GS</sub> = 0 V, f = 1.0 MHz,<br>V <sub>DS</sub> = 20 V               | - | 24.5 | - | pF |
| Output Capacitance           | C <sub>OSS</sub>    |   | - | 4.2  | - |    |
| Reverse Transfer Capacitance | C <sub>RSS</sub>    |   | - | 2.2  | - |    |
| Total Gate Charge            | Q <sub>G(TOT)</sub> | V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 10 V;<br>I <sub>D</sub> = 200 mA | - | 0.7  | - | nC |
| Threshold Gate Charge        | Q <sub>G(TH)</sub>  |   | - | 0.1  | - |    |
| Gate-to-Source Charge        | Q <sub>GS</sub>     |   | - | 0.3  | - |    |
| Gate-to-Drain Charge         | Q <sub>GD</sub>     |   | - | 0.1  | - |    |

### SWITCHING CHARACTERISTICS (Note 4)

|                     |                     |   |   |      |   |    |
|---------------------|---------------------|---|---|------|---|----|
| Turn-On Delay Time  | t <sub>d(ON)</sub>  | V <sub>GS</sub> = 10 V, V <sub>DD</sub> = 30 V,<br>I <sub>D</sub> = 200 mA, R <sub>G</sub> = 10 Ω | - | 12   | - | ns |
| Rise Time           | t <sub>r</sub>      |   | - | 7.3  | - |    |
| Turn-Off Delay Time | t <sub>d(OFF)</sub> |   | - | 63.7 | - |    |
| Fall Time           | t <sub>f</sub>      |   | - | 30.6 | - |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                       |                 |   |                       |   |     |     |   |
|-----------------------|-----------------|---|-----------------------|---|-----|-----|---|
| Forward Diode Voltage | V <sub>SD</sub> | V <sub>GS</sub> = 0 V,<br>I <sub>S</sub> = 200 mA | T <sub>J</sub> = 25°C | - | 0.8 | 1.2 | V |
|                       |                 |   | T <sub>J</sub> = 85°C | - | 0.7 | -   |   |

2. Surface-mounted on FR4 board using 1 in. sq. pad size (Cu. area = 1.127 in sq [1 oz] including traces).

3. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

4. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

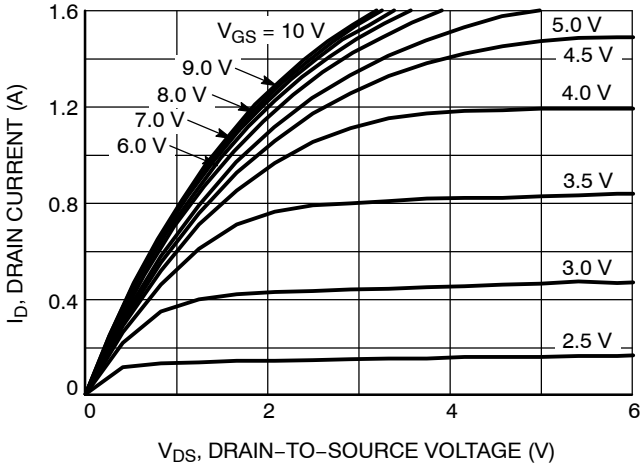


Figure 1. On-Region Characteristics

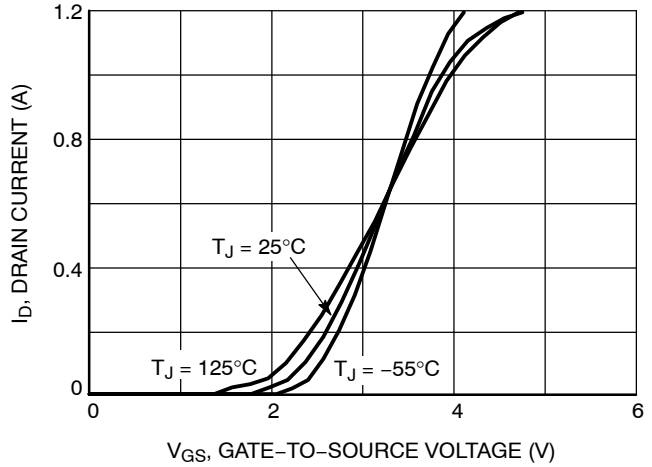


Figure 2. Transfer Characteristics

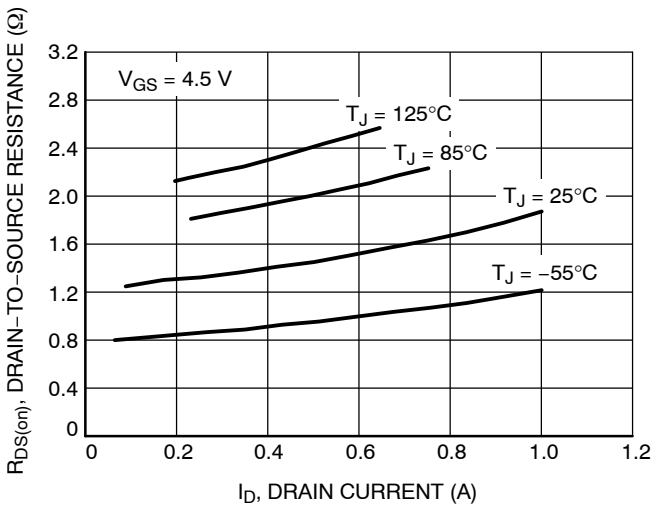


Figure 3. On-Resistance vs. Drain Current and Temperature

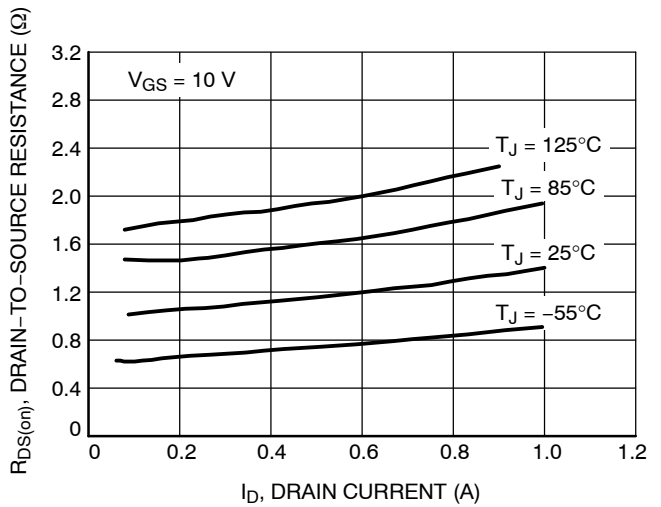


Figure 4. On-Resistance vs. Drain Current and Temperature

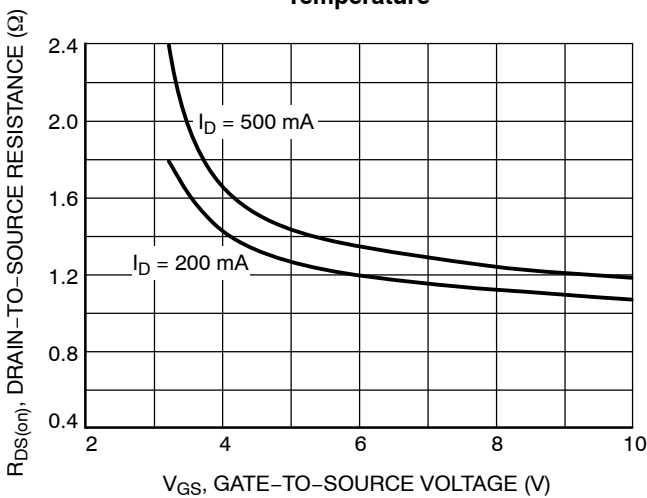


Figure 5. On-Resistance vs. Gate-to-Source Voltage

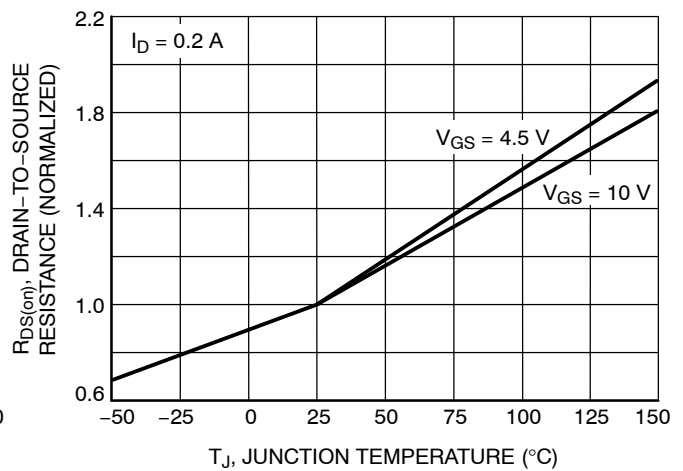
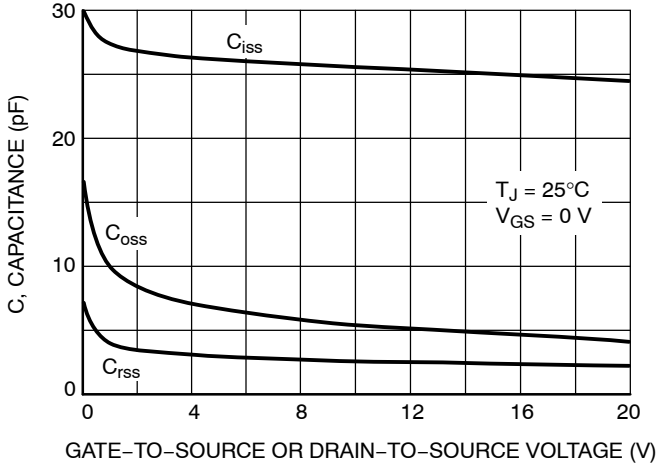


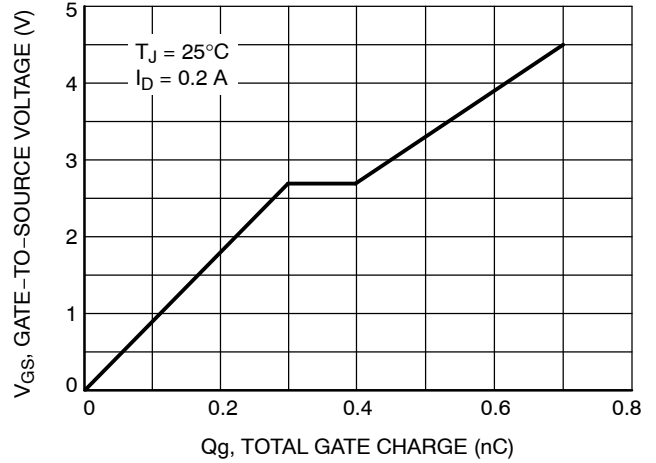
Figure 6. On-Resistance Variation with Temperature

# NTZD5110N

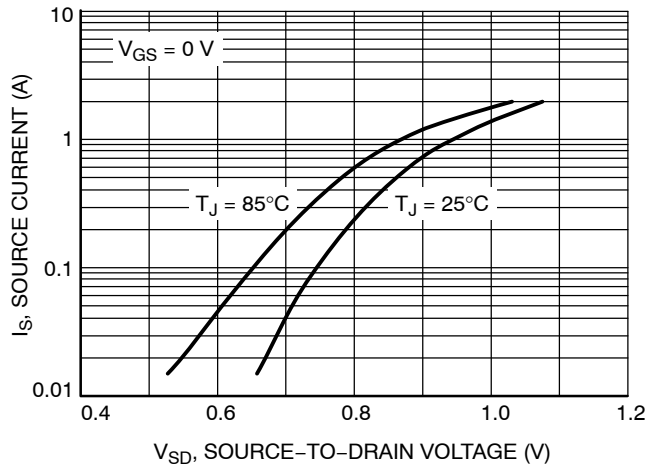
## TYPICAL CHARACTERISTICS



**Figure 7. Capacitance Variation**



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



**Figure 9. Diode Forward Voltage vs. Current**

### ORDERING INFORMATION

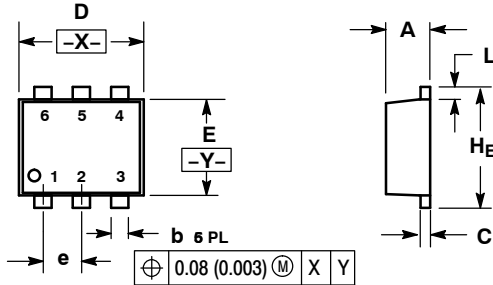
| Device       | Package              | Shipping           |
|--------------|----------------------|--------------------|
| NTZD5110NT1G | SOT-563<br>(Pb-Free) | 4000 / Tape & Reel |
| NTZD5110NT5G | SOT-563<br>(Pb-Free) | 8000 / Tape & Reel |

†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.

# NTZD5110N

## PACKAGE DIMENSIONS

SOT-563, 6 LEAD  
CASE 463A-01  
ISSUE F

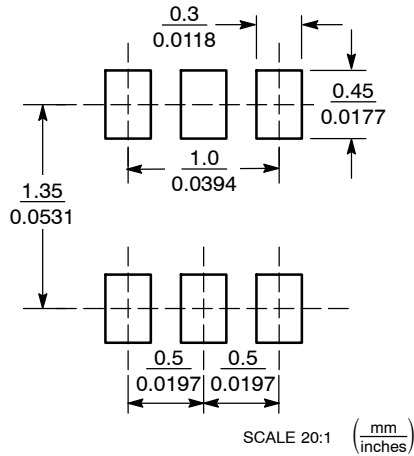


### NOTES:

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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