

# NTZD3155C

## MOSFET – Small Signal, Complementary with ESD Protection, SOT-563

20 V, 540 mA / -430 mA

### Features

- Leading Trench Technology for Low  $R_{DS(on)}$  Performance
- High Efficiency System Performance
- Low Threshold Voltage
- ESD Protected Gate
- Small Footprint 1.6 x 1.6 mm
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

- DC-DC Conversion Circuits
- Load/Power Switching with Level Shift
- Single or Dual Cell Li-Ion Battery Operated Systems
- High Speed Circuits
- Cell Phones, MP3s, Digital Cameras, and PDAs

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

| Parameter                                                         |              |                        | Symbol                            | Value      | Unit |
|-------------------------------------------------------------------|--------------|------------------------|-----------------------------------|------------|------|
| Drain-to-Source Voltage                                           |              |                        | V <sub>DSS</sub>                  | 20         | V    |
| Gate-to-Source Voltage                                            |              |                        | V <sub>GS</sub>                   | ±6         | V    |
| N-Channel Continuous Drain Current (Note 1)                       | Steady State | T <sub>A</sub> = 25°C  | I <sub>D</sub>                    | 540        | mA   |
|                                                                   |              | T <sub>A</sub> = 85°C  |                                   | 390        |      |
|                                                                   | t ≤ 5 s      | T <sub>A</sub> = 25°C  |                                   | 570        |      |
| P-Channel Continuous Drain Current (Note 1)                       | Steady State | T <sub>A</sub> = 25°C  |                                   | -430       |      |
|                                                                   |              | T <sub>A</sub> = 85°C  |                                   | -310       |      |
|                                                                   | t ≤ 5 s      | T <sub>A</sub> = 25°C  |                                   | -455       |      |
| Power Dissipation (Note 1)                                        | Steady State | T <sub>A</sub> = 25°C  | P <sub>D</sub>                    | 250        | mW   |
|                                                                   | t ≤ 5 s      |                        |                                   | 280        |      |
| Pulsed Drain Current                                              | N-Channel    | t <sub>p</sub> = 10 μs | I <sub>DM</sub>                   | 1500       | mA   |
|                                                                   | P-Channel    |                        |                                   | -750       |      |
| Operating Junction and Storage Temperature                        |              |                        | T <sub>J</sub> , T <sub>STG</sub> | -55 to 150 | °C   |
| Source Current (Body Diode)                                       |              |                        | I <sub>S</sub>                    | 350        | mA   |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) |              |                        | T <sub>L</sub>                    | 260        | °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 1 in sq. pad size (Cu area = 1.127 in sq [1 oz] including traces).

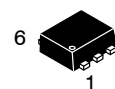
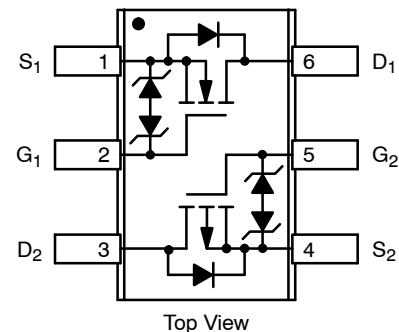


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| $V_{(BR)DSS}$      | $R_{DS(on)}$ Typ      | $I_D$ Max (Note 1) |
|--------------------|-----------------------|--------------------|
| N-Channel<br>20 V  | 0.4 $\Omega$ @ 4.5 V  | 540 mA             |
|                    | 0.5 $\Omega$ @ 2.5 V  |                    |
|                    | 0.7 $\Omega$ @ 1.8 V  |                    |
| P-Channel<br>-20 V | 0.5 $\Omega$ @ -4.5 V | -430 mA            |
|                    | 0.6 $\Omega$ @ -2.5 V |                    |
|                    | 1.0 $\Omega$ @ -1.8 V |                    |

### PINOUT: SOT-563



SOT-563-6  
CASE 463A

### MARKING DIAGRAM



TW = Specific Device Code  
M = Date Code  
■ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

| Device       | Package              | Shipping†          |
|--------------|----------------------|--------------------|
| NTZD3155CT1G | SOT-563<br>(Pb-Free) | 4000 / Tape & Reel |
| NTZD3155CT2G |                      |                    |
| NTZD3155CT5G |                      | 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.

# NTZD3155C

## Thermal Resistance Ratings

| Parameter                                   | Symbol          | Max | Unit                 |
|---------------------------------------------|-----------------|-----|----------------------|
| Junction-to-Ambient – Steady State (Note 2) | $R_{\theta JA}$ | 500 | $^{\circ}\text{C/W}$ |
| Junction-to-Ambient – $t = 5$ s (Note 2)    |                 | 447 |                      |

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

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

| Parameter                                                 | Symbol            | N/P | Test Condition                                   | Min                             | Typ | Max       | Unit                   |
|-----------------------------------------------------------|-------------------|-----|--------------------------------------------------|---------------------------------|-----|-----------|------------------------|
| <b>OFF CHARACTERISTICS</b>                                |                   |     |                                                  |                                 |     |           |                        |
| Drain-to-Source Breakdown Voltage                         | $V_{(BR)DSS}$     | N   | $V_{GS} = 0\text{ V}$                            | $I_D = 250\text{ }\mu\text{A}$  | 20  |           | V                      |
|                                                           |                   | P   |                                                  | $I_D = -250\text{ }\mu\text{A}$ | -20 |           |                        |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ |     |                                                  |                                 | 18  |           | mV/ $^{\circ}\text{C}$ |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | N   | $V_{GS} = 0\text{ V}, V_{DS} = 16\text{ V}$      | $T_J = 25^{\circ}\text{C}$      |     | 1.0       | $\mu\text{A}$          |
|                                                           |                   | P   | $V_{GS} = 0\text{ V}, V_{DS} = -16\text{ V}$     |                                 |     | -1.0      |                        |
|                                                           |                   | N   | $V_{GS} = 0\text{ V}, V_{DS} = 16\text{ V}$      | $T_J = 125^{\circ}\text{C}$     |     | 2.0       | $\mu\text{A}$          |
|                                                           |                   | P   | $V_{GS} = 0\text{ V}, V_{DS} = -16\text{ V}$     |                                 |     | -5.0      |                        |
| Gate-to-Source Leakage Current                            | $I_{GSS}$         | P   | $V_{DS} = 0\text{ V}, V_{GS} = \pm 4.5\text{ V}$ |                                 |     | $\pm 2.0$ | $\mu\text{A}$          |
|                                                           |                   | N   |                                                  |                                 |     | $\pm 5.0$ |                        |

## ON CHARACTERISTICS (Note 3)

|                                        |                  |   |                                                |                                 |       |      |                         |
|----------------------------------------|------------------|---|------------------------------------------------|---------------------------------|-------|------|-------------------------|
| Gate Threshold Voltage                 | $V_{GS(TH)}$     | N | $V_{GS} = V_{DS}$                              | $I_D = 250\text{ }\mu\text{A}$  | 0.45  | 1.0  | V                       |
|                                        |                  | P |                                                | $I_D = -250\text{ }\mu\text{A}$ | -0.45 | -1.0 |                         |
| Gate Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ |   |                                                |                                 | -1.9  |      | -mV/ $^{\circ}\text{C}$ |
| Drain-to-Source On Resistance          | $R_{DS(on)}$     | N | $V_{GS} = 4.5\text{ V}, I_D = 540\text{ mA}$   |                                 | 0.4   | 0.55 | $\Omega$                |
|                                        |                  | P | $V_{GS} = -4.5\text{ V}, I_D = -430\text{ mA}$ |                                 | 0.5   | 0.9  |                         |
|                                        |                  | N | $V_{GS} = 2.5\text{ V}, I_D = 500\text{ mA}$   |                                 | 0.5   | 0.7  |                         |
|                                        |                  | P | $V_{GS} = -2.5\text{ V}, I_D = -300\text{ mA}$ |                                 | 0.6   | 1.2  |                         |
|                                        |                  | N | $V_{GS} = 1.8\text{ V}, I_D = 350\text{ mA}$   |                                 | 0.7   | 0.9  |                         |
|                                        |                  | P | $V_{GS} = -1.8\text{ V}, I_D = -150\text{ mA}$ |                                 | 1.0   | 2.0  |                         |
| Forward Transconductance               | $g_{FS}$         | N | $V_{DS} = 10\text{ V}, I_D = 540\text{ mA}$    |                                 | 1.0   |      | S                       |
|                                        |                  | P | $V_{DS} = -10\text{ V}, I_D = -430\text{ mA}$  |                                 | 1.0   |      |                         |

## CHARGES, CAPACITANCES AND GATE RESISTANCE

|                              |           |   |                                                                    |  |     |     |    |
|------------------------------|-----------|---|--------------------------------------------------------------------|--|-----|-----|----|
| Input Capacitance            | $C_{ISS}$ | N | $f = 1\text{ MHz}, V_{GS} = 0\text{ V}$<br>$V_{DS} = 16\text{ V}$  |  | 80  | 150 | pF |
| Output Capacitance           | $C_{OSS}$ |   |                                                                    |  | 13  | 25  |    |
| Reverse Transfer Capacitance | $C_{RSS}$ |   |                                                                    |  | 10  | 20  |    |
| Input Capacitance            | $C_{ISS}$ | P | $f = 1\text{ MHz}, V_{GS} = 0\text{ V}$<br>$V_{DS} = -16\text{ V}$ |  | 105 | 175 |    |
| Output Capacitance           | $C_{OSS}$ |   |                                                                    |  | 15  | 30  |    |
| Reverse Transfer Capacitance | $C_{RSS}$ |   |                                                                    |  | 10  | 20  |    |

3. Pulse Test: pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$

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.

# NTZD3155C

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

| Parameter | Symbol | N/P | Test Condition | Min | Typ | Max | Unit |
|-----------|--------|-----|----------------|-----|-----|-----|------|
|-----------|--------|-----|----------------|-----|-----|-----|------|

### CHARGES, CAPACITANCES AND GATE RESISTANCE

|                       |              |   |                                                                      |  |      |     |    |
|-----------------------|--------------|---|----------------------------------------------------------------------|--|------|-----|----|
| Total Gate Charge     | $Q_{G(TOT)}$ | N | $V_{GS} = 4.5\text{ V}, V_{DS} = -10\text{ V}; I_D = 540\text{ mA}$  |  | 1.5  | 2.5 | nC |
| Threshold Gate Charge | $Q_{G(TH)}$  |   |                                                                      |  | 0.1  |     |    |
| Gate-to-Source Charge | $Q_{GS}$     |   |                                                                      |  | 0.2  |     |    |
| Gate-to-Drain Charge  | $Q_{GD}$     |   |                                                                      |  | 0.35 |     |    |
| Total Gate Charge     | $Q_{G(TOT)}$ | P | $V_{GS} = -4.5\text{ V}, V_{DS} = 10\text{ V}; I_D = -380\text{ mA}$ |  | 1.7  | 2.5 |    |
| Threshold Gate Charge | $Q_{G(TH)}$  |   |                                                                      |  | 0.1  |     |    |
| Gate-to-Source Charge | $Q_{GS}$     |   |                                                                      |  | 0.3  |     |    |
| Gate-to-Drain Charge  | $Q_{GD}$     |   |                                                                      |  | 0.4  |     |    |

### SWITCHING CHARACTERISTICS ( $V_{GS} = V$ ) (Note 4)

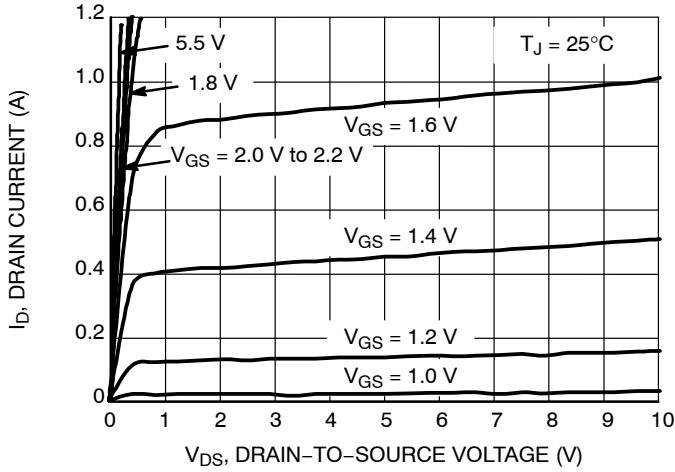
|                     |              |   |                                                                                        |  |     |  |    |
|---------------------|--------------|---|----------------------------------------------------------------------------------------|--|-----|--|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | N | $V_{GS} = 4.5\text{ V}, V_{DD} = -10\text{ V}, I_D = 540\text{ mA}, R_G = 10\ \Omega$  |  | 6.0 |  | ns |
| Rise Time           | $t_r$        |   |                                                                                        |  | 4.0 |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |   |                                                                                        |  | 16  |  |    |
| Fall Time           | $t_f$        |   |                                                                                        |  | 8.0 |  |    |
| Turn-On Delay Time  | $t_{d(ON)}$  | P | $V_{GS} = -4.5\text{ V}, V_{DD} = 10\text{ V}, I_D = -215\text{ mA}, R_G = 10\ \Omega$ |  | 10  |  |    |
| Rise Time           | $t_r$        |   |                                                                                        |  | 12  |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |   |                                                                                        |  | 35  |  |    |
| Fall Time           | $t_f$        |   |                                                                                        |  | 19  |  |    |

### Drain-Source Diode Characteristics

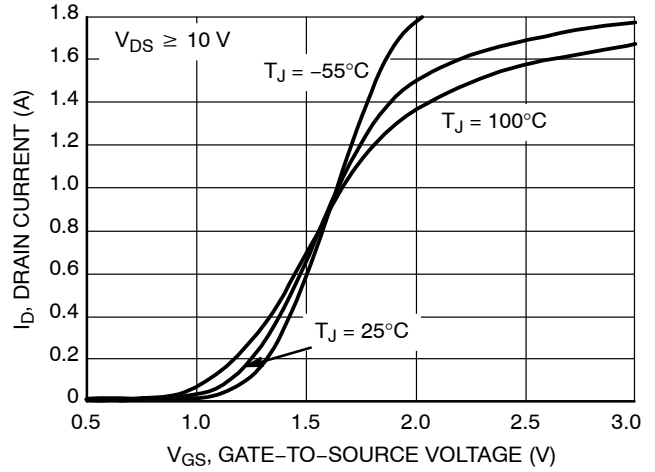
|                       |          |   |                                                           |                        |  |      |      |    |
|-----------------------|----------|---|-----------------------------------------------------------|------------------------|--|------|------|----|
| Forward Diode Voltage | $V_{SD}$ | N | $V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$             | $I_S = 350\text{ mA}$  |  | 0.7  | 1.2  | V  |
|                       |          | P |                                                           | $I_S = -350\text{ mA}$ |  | -0.8 | -1.2 |    |
| Reverse Recovery Time | $t_{RR}$ | N | $V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}$ | $I_S = 350\text{ mA}$  |  | 6.5  |      | ns |
|                       |          | P |                                                           | $I_S = -350\text{ mA}$ |  | 13   |      |    |

4. Switching characteristics are independent of operating junction temperatures

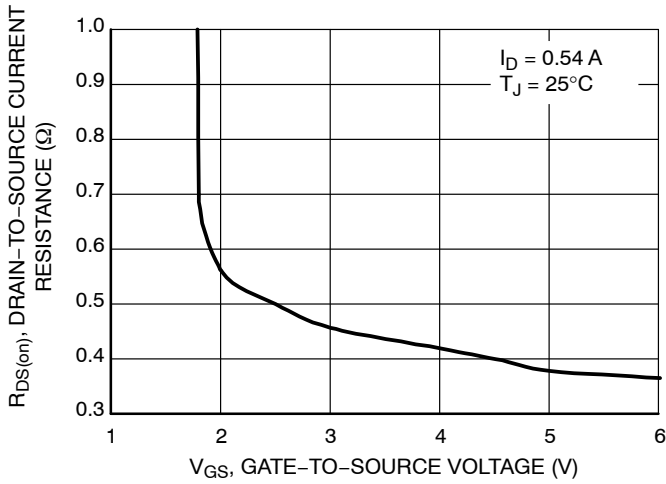
**N-CHANNEL TYPICAL PERFORMANCE CURVES** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)



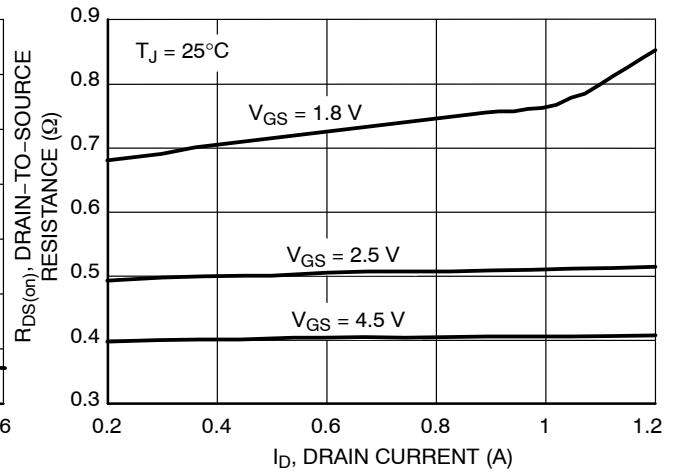
**Figure 1. On-Region Characteristics**



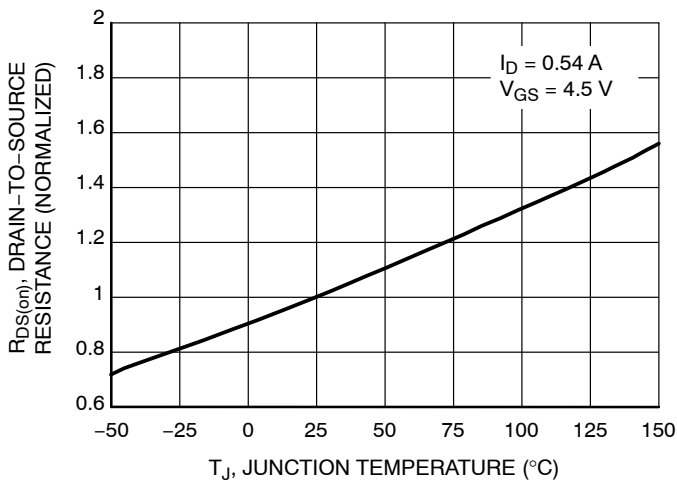
**Figure 2. Transfer Characteristics**



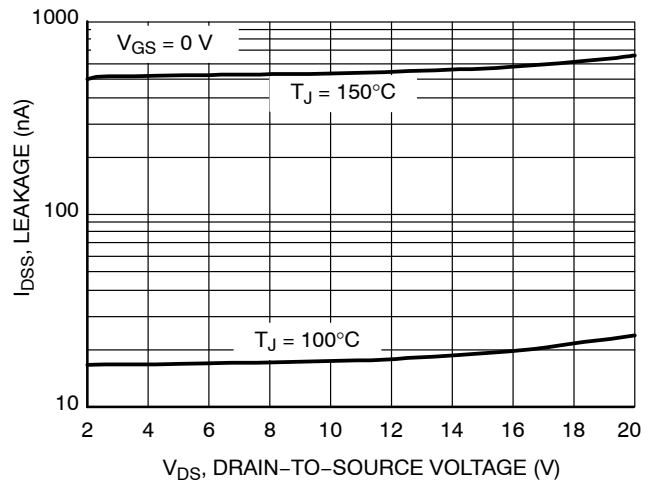
**Figure 3. On-Resistance versus Gate-to-Source Voltage**



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



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



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

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

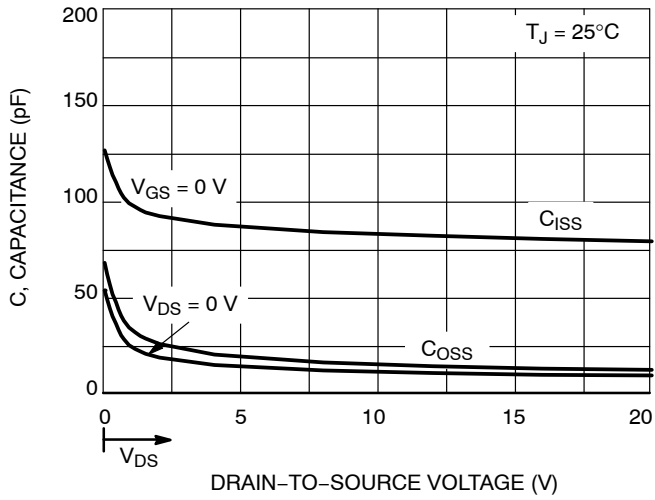


Figure 7. Capacitance Variation

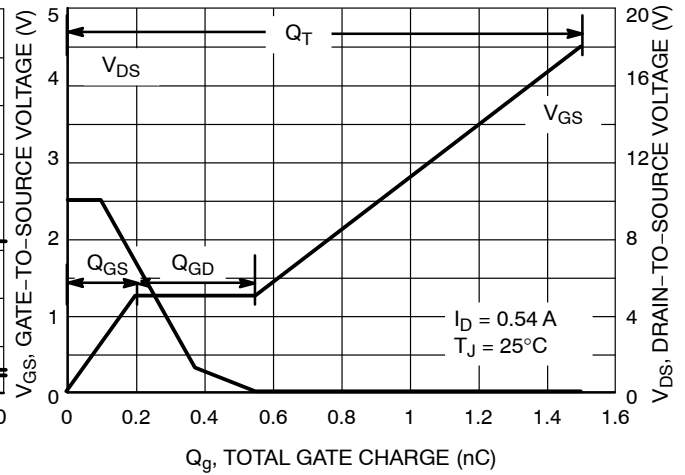


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

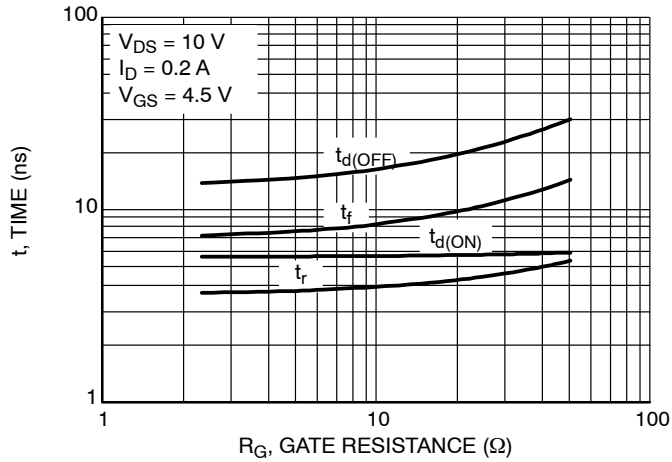


Figure 9. Resistive Switching Time Variation versus Gate Resistance

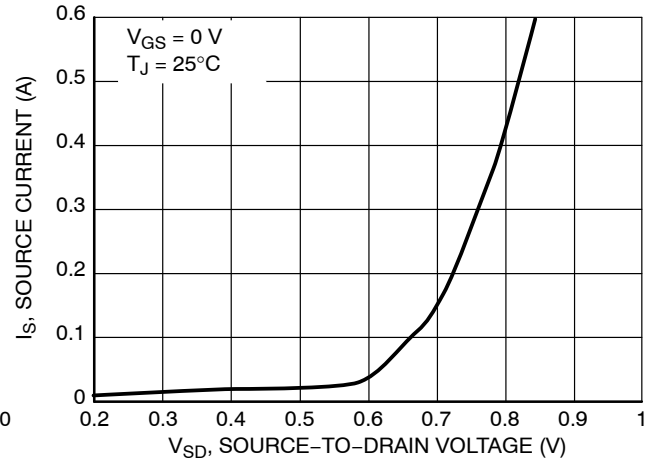
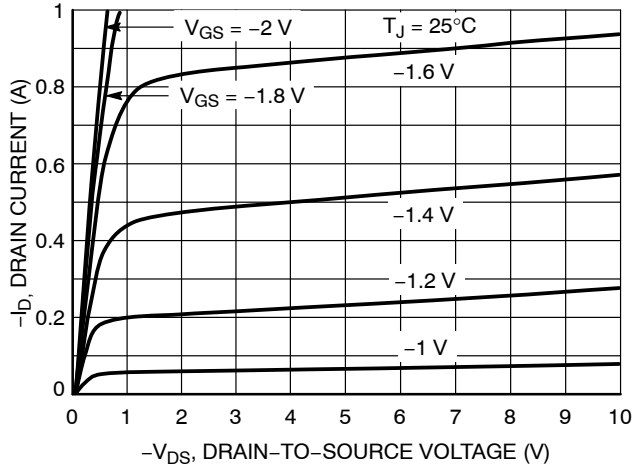
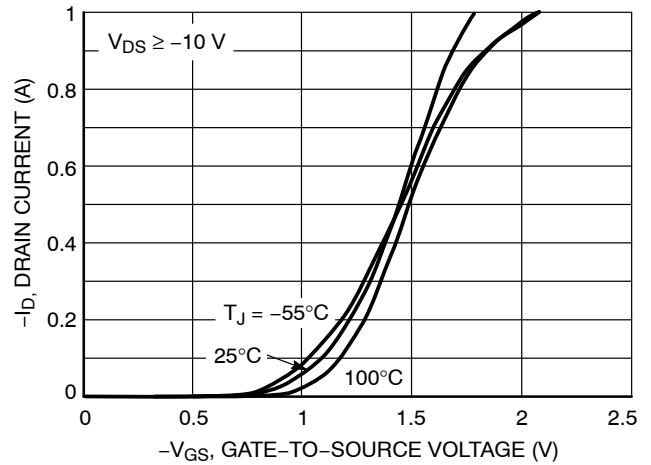


Figure 10. Diode Forward Voltage versus Current

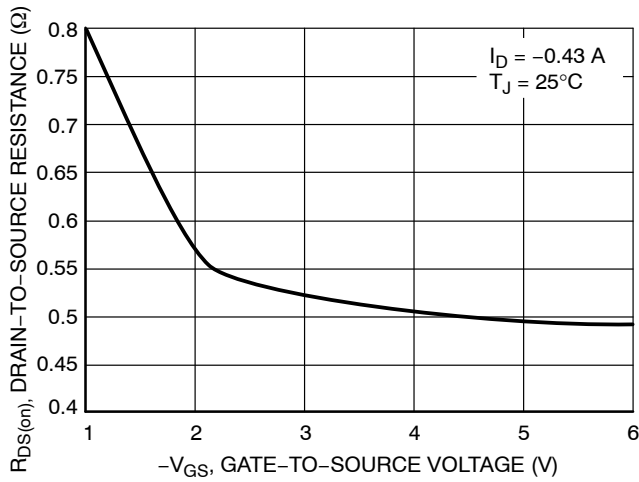
**P-CHANNEL TYPICAL PERFORMANCE CURVES** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)



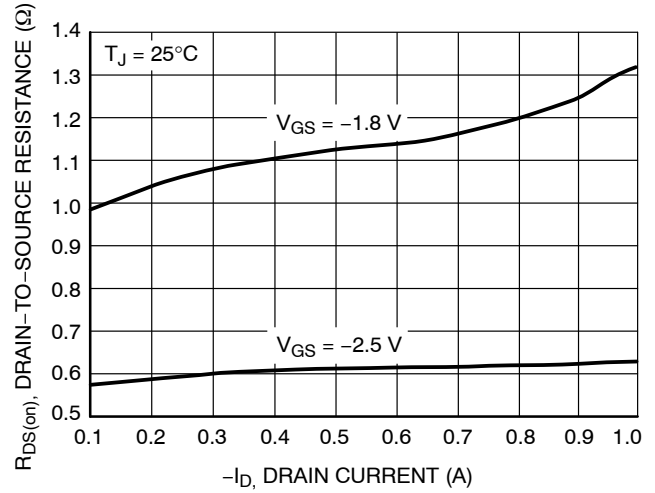
**Figure 1. On-Region Characteristics**



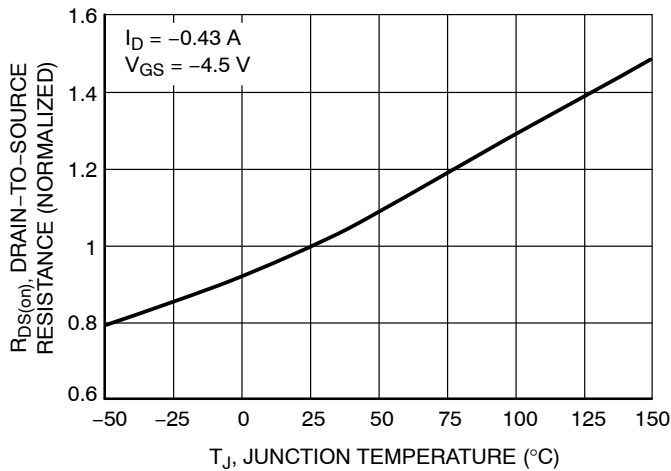
**Figure 2. Transfer Characteristics**



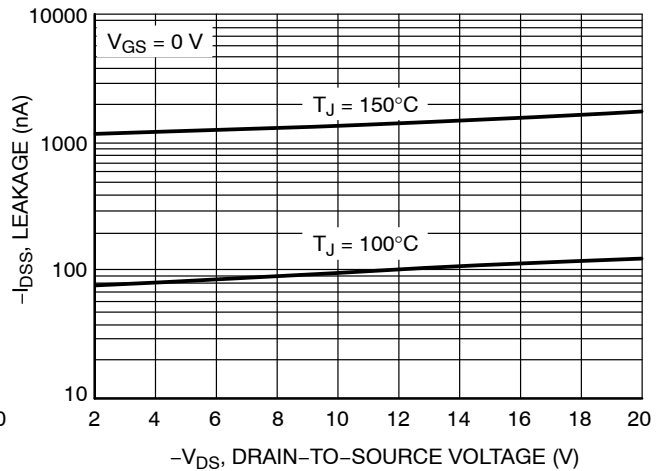
**Figure 3. On-Resistance vs. Gate-to-Source Voltage**



**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**

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

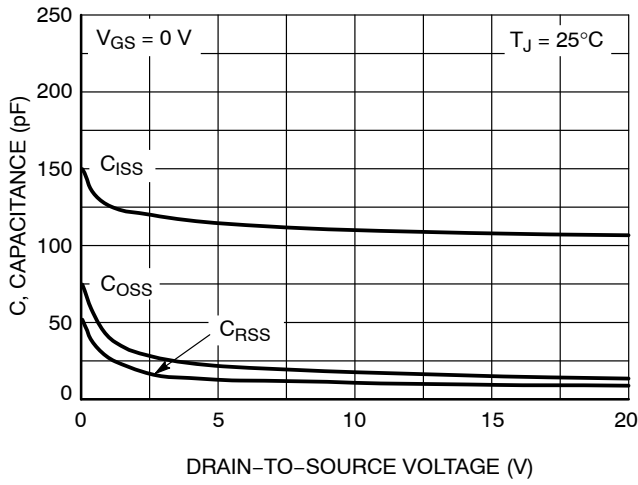


Figure 7. Capacitance Variation

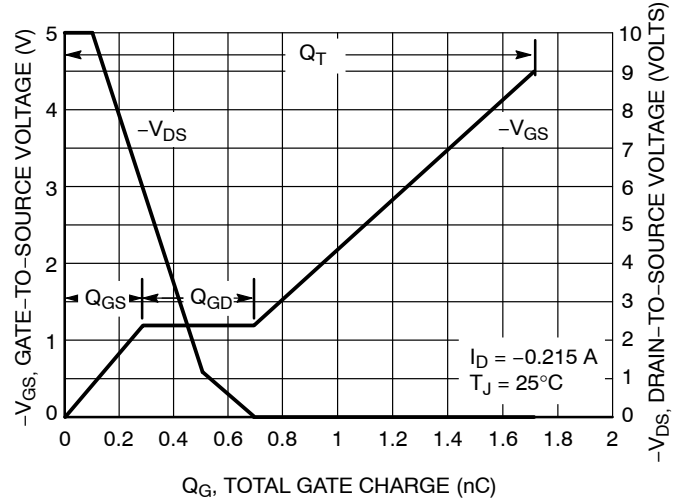


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

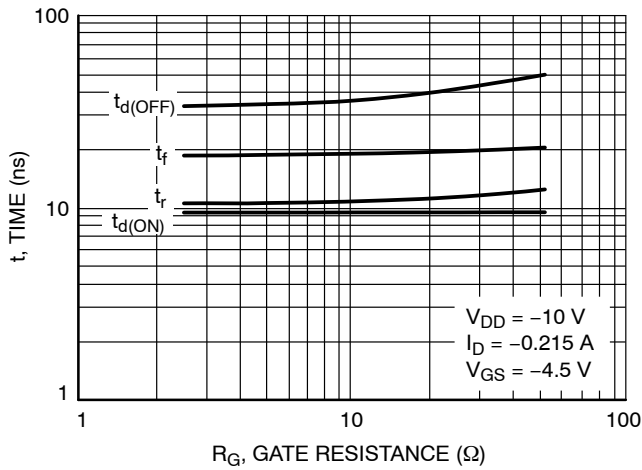


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

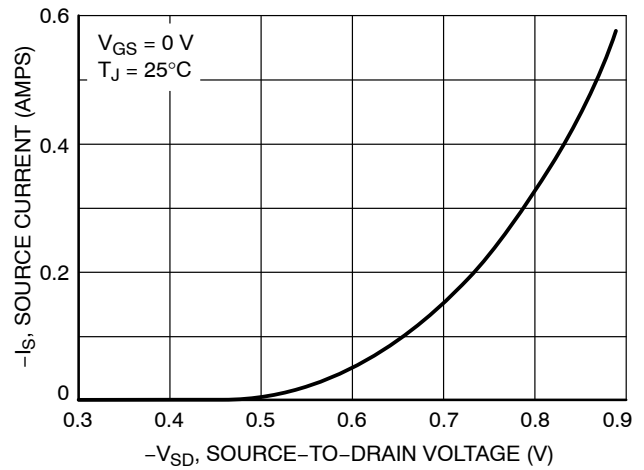


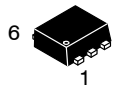
Figure 10. Diode Forward Voltage vs. Current

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®

ON



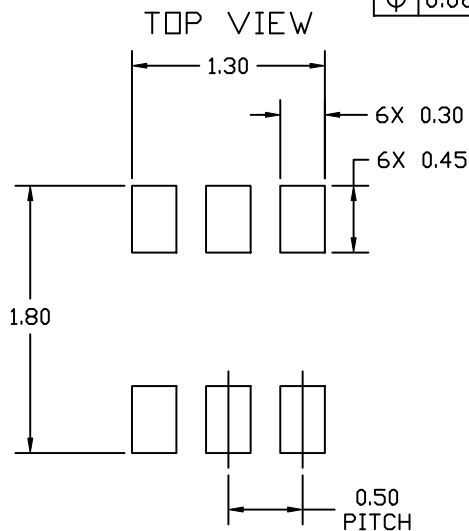
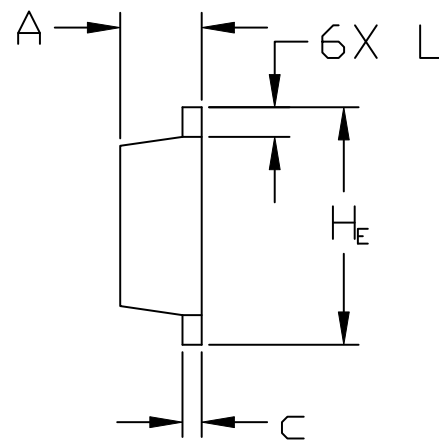
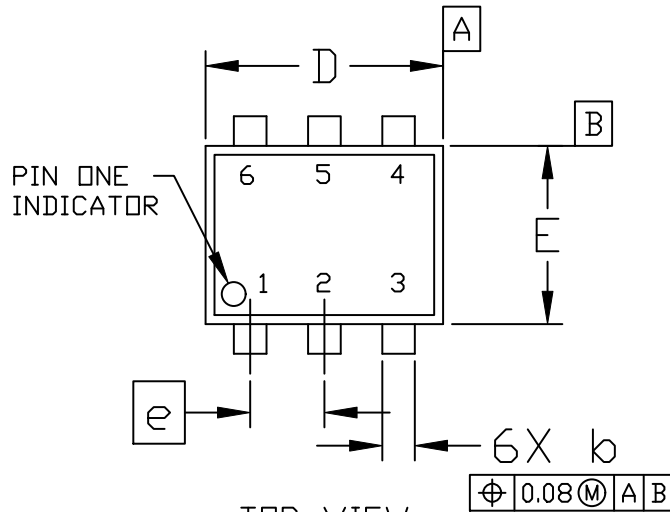
SCALE 4:1

**SOT-563, 6 LEAD**  
CASE 463A  
ISSUE H

DATE 26 JAN 2021

### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.



SIDE VIEW

| DIM            | MILLIMETERS |      |      |
|----------------|-------------|------|------|
|                | MIN.        | NOM. | MAX. |
| A              | 0.50        | 0.55 | 0.60 |
| b              | 0.17        | 0.22 | 0.27 |
| c              | 0.08        | 0.13 | 0.18 |
| D              | 1.50        | 1.60 | 1.70 |
| E              | 1.10        | 1.20 | 1.30 |
| e              | 0.50 BSC    |      |      |
| L              | 0.10        | 0.20 | 0.30 |
| H <sub>E</sub> | 1.50        | 1.60 | 1.70 |

### RECOMMENDED MOUNTING 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-563, 6 LEAD</b> | <b>PAGE 1 OF 2</b>                                                                                                                                                               |

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**SOT-563, 6 LEAD**  
CASE 463A  
ISSUE H

DATE 26 JAN 2021

STYLE 1:  
PIN 1. EMITTER 1  
2. BASE 1  
3. COLLECTOR 2  
4. EMITTER 2  
5. BASE 2  
6. COLLECTOR 1

STYLE 2:  
PIN 1. EMITTER 1  
2. EMITTER 2  
3. BASE 2  
4. COLLECTOR 2  
5. BASE 1  
6. COLLECTOR 1

STYLE 3:  
PIN 1. CATHODE 1  
2. CATHODE 1  
3. ANODE/ANODE 2  
4. CATHODE 2  
5. CATHODE 2  
6. ANODE/ANODE 1

STYLE 4:  
PIN 1. COLLECTOR  
2. COLLECTOR  
3. BASE  
4. EMITTER  
5. COLLECTOR  
6. COLLECTOR

STYLE 5:  
PIN 1. CATHODE  
2. CATHODE  
3. ANODE  
4. ANODE  
5. CATHODE  
6. CATHODE

STYLE 6:  
PIN 1. CATHODE  
2. ANODE  
3. CATHODE  
4. CATHODE  
5. CATHODE  
6. CATHODE

STYLE 7:  
PIN 1. CATHODE  
2. ANODE  
3. CATHODE  
4. CATHODE  
5. ANODE  
6. CATHODE

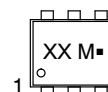
STYLE 8:  
PIN 1. DRAIN  
2. DRAIN  
3. GATE  
4. SOURCE  
5. DRAIN  
6. DRAIN

STYLE 9:  
PIN 1. SOURCE 1  
2. GATE 1  
3. DRAIN 2  
4. SOURCE 2  
5. GATE 2  
6. DRAIN 1

STYLE 10:  
PIN 1. CATHODE 1  
2. N/C  
3. CATHODE 2  
4. ANODE 2  
5. N/C  
6. ANODE 1

STYLE 11:  
PIN 1. EMITTER 2  
2. BASE 2  
3. COLLECTOR 1  
4. EMITTER 1  
5. BASE 1  
6. COLLECTOR 2

**GENERIC  
MARKING DIAGRAM\***



XX = Specific Device Code  
M = Month Code  
■ = Pb-Free Package

\*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. Some products may not follow the Generic Marking.

|                         |                        |                                                                                                                                                                                     |
|-------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <b>DESCRIPTION:</b>     | <b>SOT-563, 6 LEAD</b> | <b>PAGE 2 OF 2</b>                                                                                                                                                                  |

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