

# NTZD3155C

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

20 V, 540 mA / -430 mA



ON Semiconductor®

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### 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)

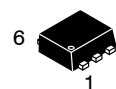
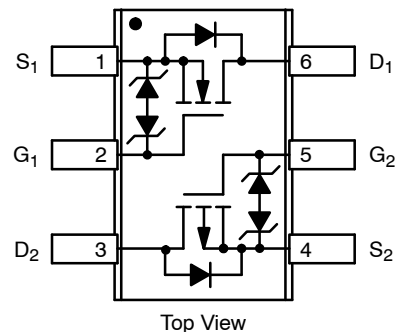
Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			$V_{DSS}$	20	V
Gate-to-Source Voltage			$V_{GS}$	$\pm 6$	V
N-Channel Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	540	mA
		$T_A = 85^\circ\text{C}$		390	
P-Channel Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$		-430	
		$T_A = 85^\circ\text{C}$		-310	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	250	mW
				$t \leq 5$ s	
Pulsed Drain Current	N-Channel	$t_p = 10 \mu\text{s}$	$I_{DM}$	1500	mA
	P-Channel			-750	
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	$^\circ\text{C}$

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).

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

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## Thermal Resistance Ratings

Parameter	Symbol	Max	Unit
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	500	°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	$V_{GS} = 0\text{ V}$	$I_D = 250\ \mu\text{A}$	20		V
		P		$I_D = -250\ \mu\text{A}$	-20		
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$				18		mV/°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	$V_{GS} = V_{DS}$	$I_D = 250\ \mu\text{A}$	0.45	1.0	V
		P		$I_D = -250\ \mu\text{A}$	-0.45	-1.0	
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				-1.9		-mV/°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	$f = 1\text{ MHz}, V_{GS} = 0\text{ V}$ $V_{DS} = 16\text{ V}$		80	150	pF
Output Capacitance	$C_{OSS}$				13	25	
Reverse Transfer Capacitance	$C_{RSS}$				10	20	
Input Capacitance	$C_{ISS}$	P	$f = 1\text{ MHz}, V_{GS} = 0\text{ V}$ $V_{DS} = -16\text{ V}$		105	175	
Output Capacitance	$C_{OSS}$				15	30	
Reverse Transfer Capacitance	$C_{RSS}$				10	20	

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

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

Parameter	Symbol	N/P	Test Condition	Min	Typ	Max	Unit
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### CHARGES, CAPACITANCES AND GATE RESISTANCE

Total Gate Charge	Q <sub>G(TOT)</sub>	N	V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = -10 V; I <sub>D</sub> = 540 mA		1.5	2.5	nC
Threshold Gate Charge	Q <sub>G(TH)</sub>				0.1		
Gate-to-Source Charge	Q <sub>GS</sub>				0.2		
Gate-to-Drain Charge	Q <sub>GD</sub>				0.35		
Total Gate Charge	Q <sub>G(TOT)</sub>	P	V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = 10 V; I <sub>D</sub> = -380 mA		1.7	2.5	
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>				0.4		

### SWITCHING CHARACTERISTICS (V<sub>GS</sub> = V) (Note 4)

Turn-On Delay Time	t <sub>d(ON)</sub>	N	V <sub>GS</sub> = 4.5 V, V <sub>DD</sub> = -10 V, I <sub>D</sub> = 540 mA, R <sub>G</sub> = 10 Ω		6.0		ns
Rise Time	t <sub>r</sub>				4.0		
Turn-Off Delay Time	t <sub>d(OFF)</sub>				16		
Fall Time	t <sub>f</sub>				8.0		
Turn-On Delay Time	t <sub>d(ON)</sub>	P	V <sub>GS</sub> = -4.5 V, V <sub>DD</sub> = 10 V, I <sub>D</sub> = -215 mA, R <sub>G</sub> = 10 Ω		10		
Rise Time	t <sub>r</sub>				12		
Turn-Off Delay Time	t <sub>d(OFF)</sub>				35		
Fall Time	t <sub>f</sub>				19		

### Drain-Source Diode Characteristics

Forward Diode Voltage	V <sub>SD</sub>	N	V <sub>GS</sub> = 0 V, T <sub>J</sub> = 25°C	I <sub>S</sub> = 350 mA		0.7	1.2	V
		P		I <sub>S</sub> = -350 mA		-0.8	-1.2	
Reverse Recovery Time	t <sub>RR</sub>	N	V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs	I <sub>S</sub> = 350 mA		6.5		ns
		P		I <sub>S</sub> = -350 mA		13		

4. Switching characteristics are independent of operating junction temperatures

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

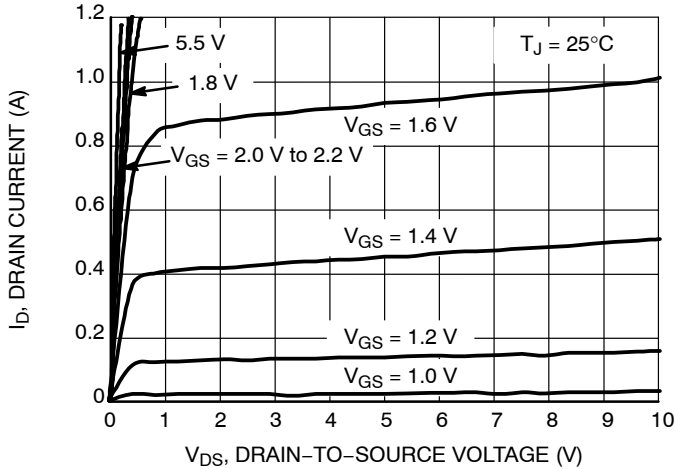


Figure 1. On-Region Characteristics

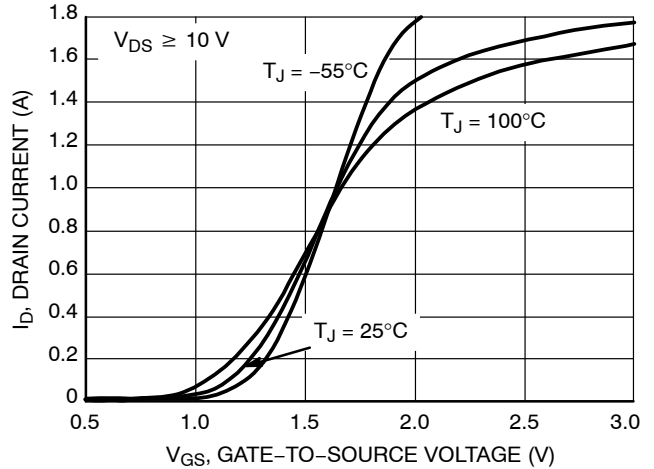


Figure 2. Transfer Characteristics

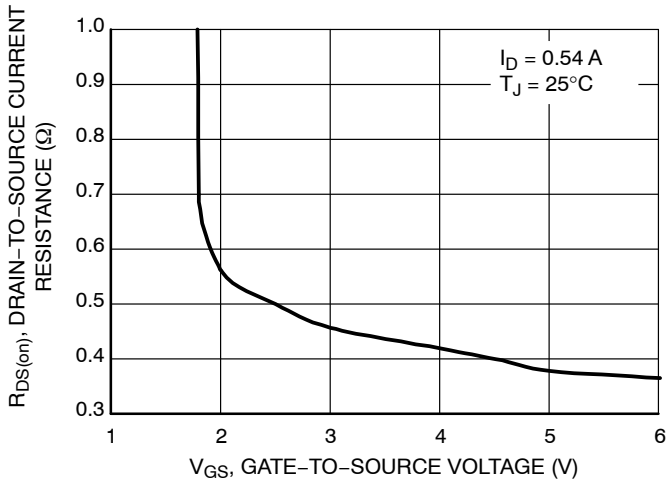


Figure 3. On-Resistance versus Gate-to-Source Voltage

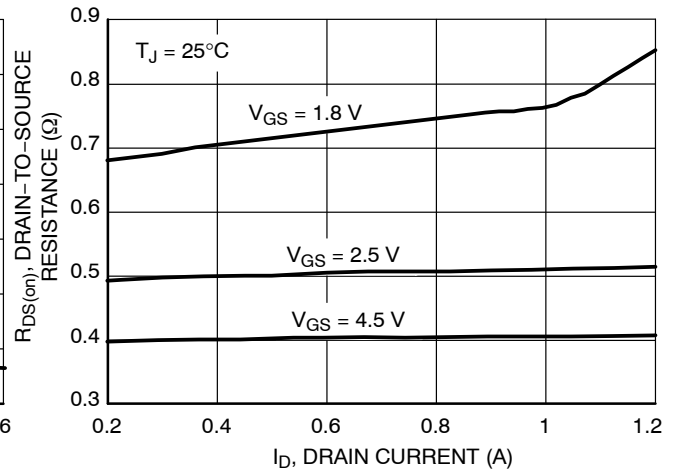


Figure 4. On-Resistance versus Drain Current and Gate Voltage

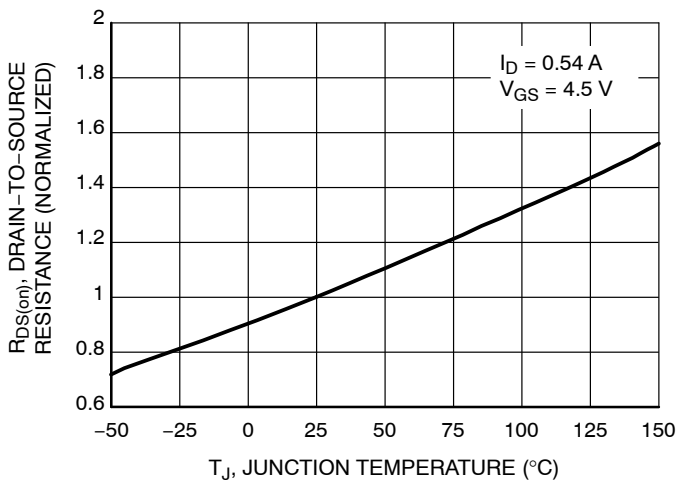


Figure 5. On-Resistance Variation with Temperature

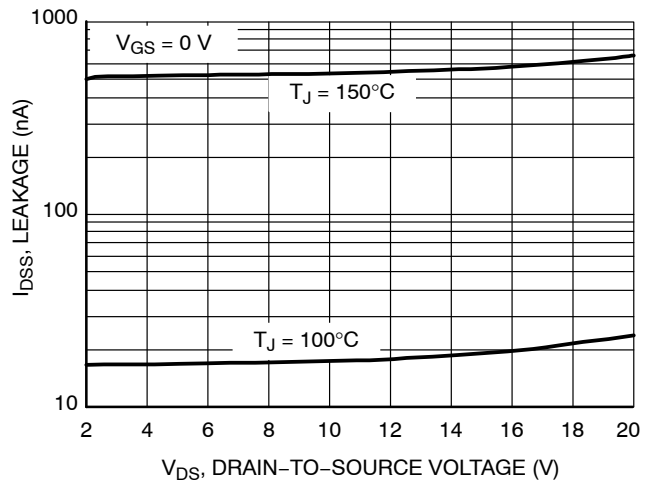
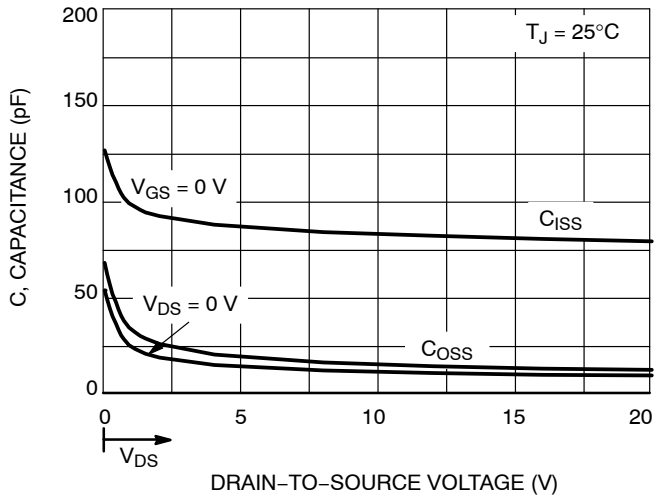


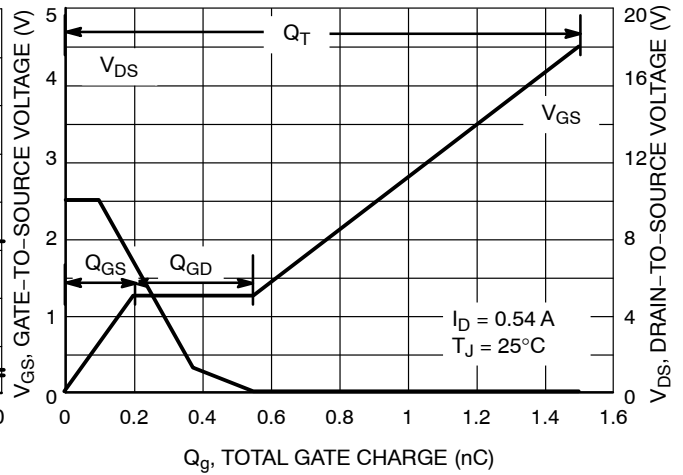
Figure 6. Drain-to-Source Leakage Current versus Voltage

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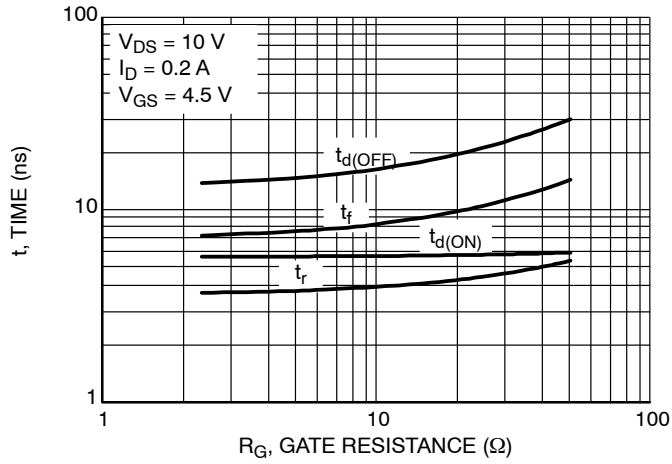
## N-CHANNEL TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)



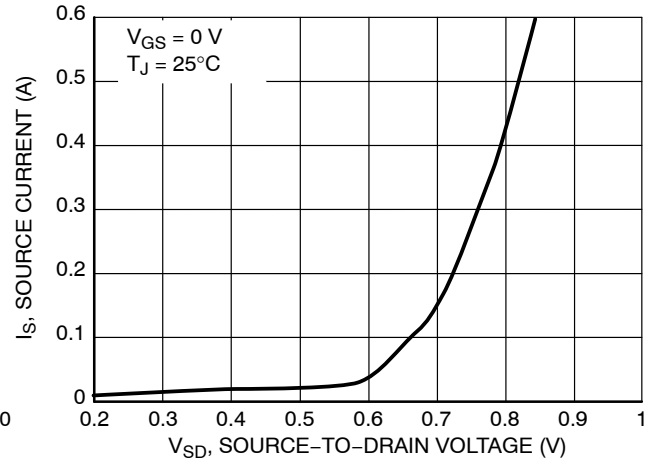
**Figure 7. Capacitance Variation**



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



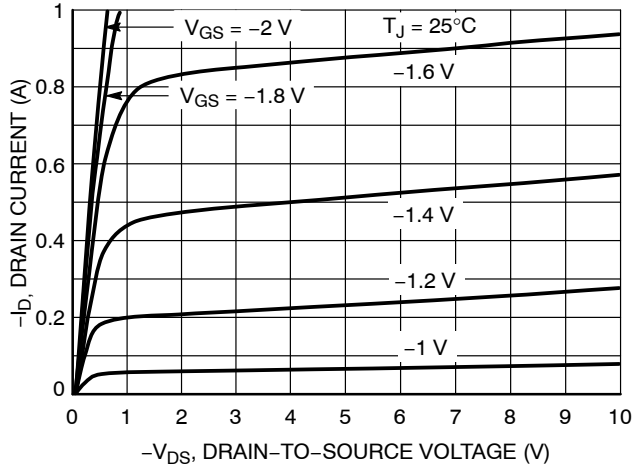
**Figure 9. Resistive Switching Time Variation versus Gate Resistance**



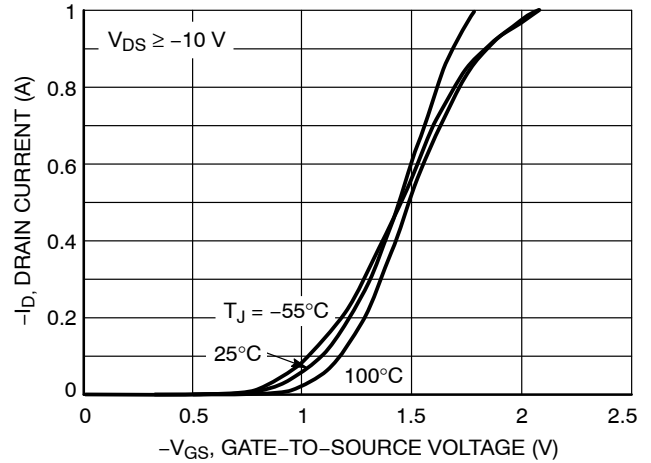
**Figure 10. Diode Forward Voltage versus Current**

# NTZD3155C

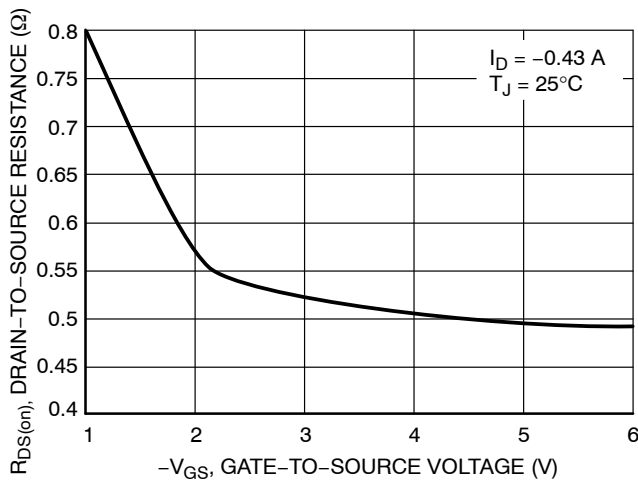
## P-CHANNEL TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)



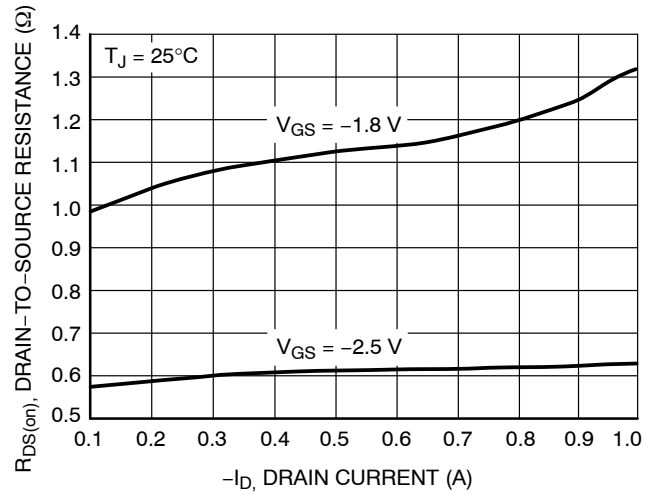
**Figure 1. On-Region Characteristics**



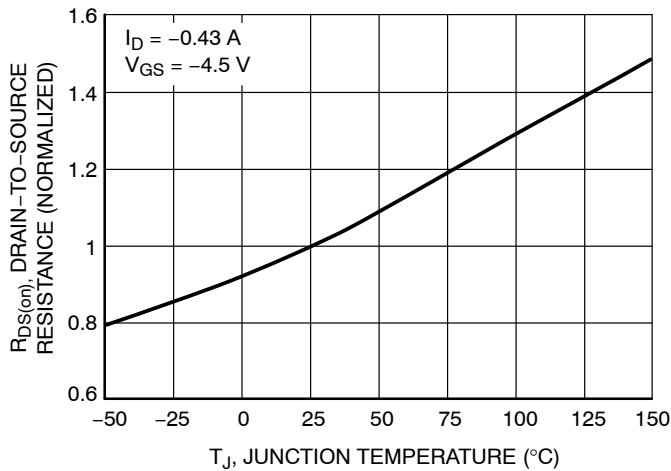
**Figure 2. Transfer Characteristics**



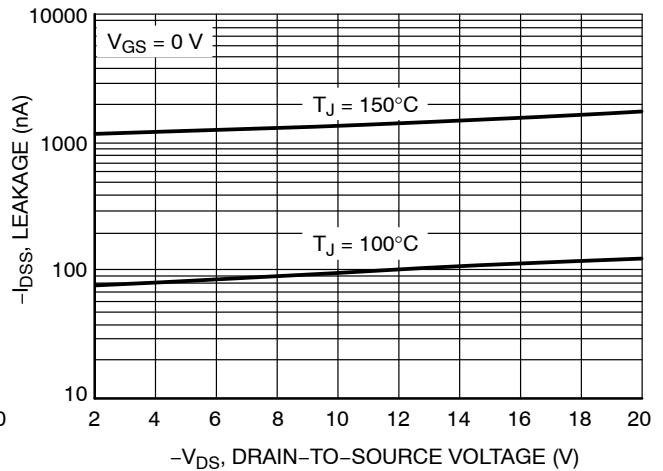
**Figure 3. On-Resistance vs. Gate-to-Source Voltage**



**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**

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

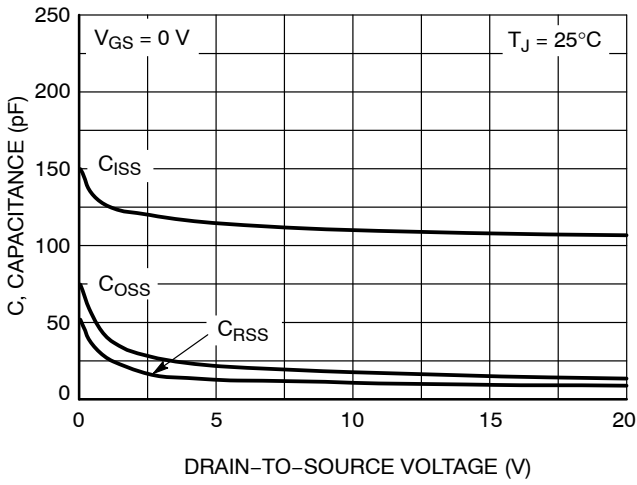


Figure 7. Capacitance Variation

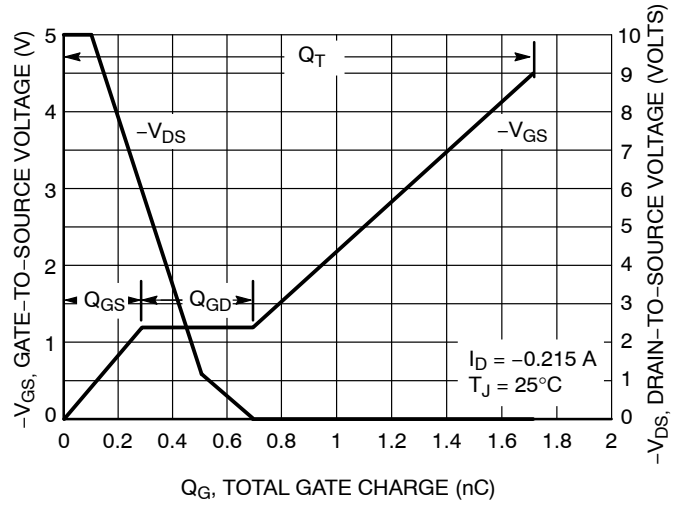


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

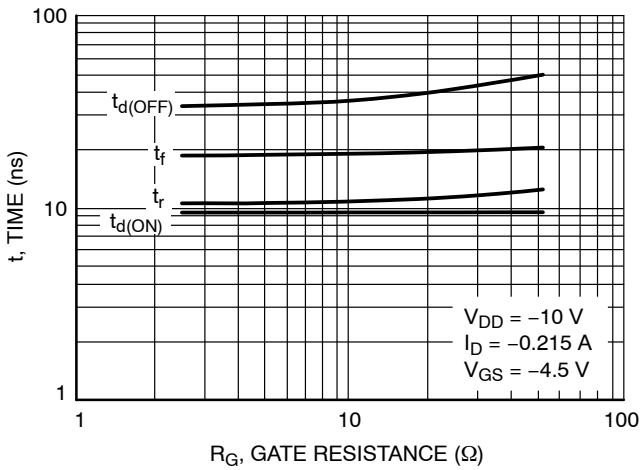


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

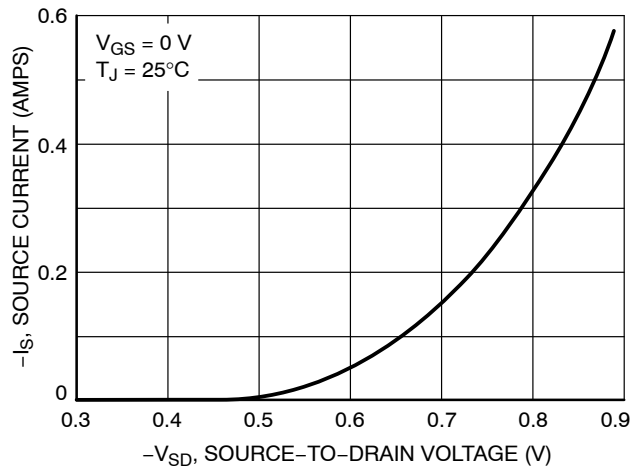


Figure 10. Diode Forward Voltage vs. Current

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

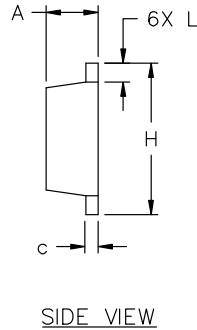
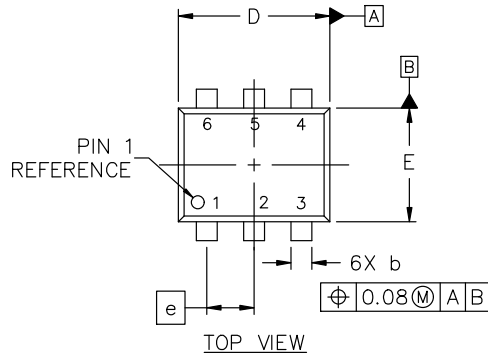


**SOT-563-6 1.60x1.20x0.55, 0.50P**  
**CASE 463A**  
**ISSUE J**

DATE 15 FEB 2024

**NOTES:**

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.



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		
H	1.50	1.60	1.70
L	0.10	0.20	0.30

**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

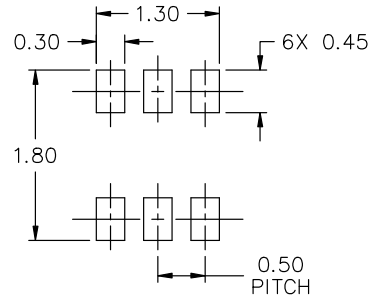
**STYLE 7:**  
 PIN 1. CATHODE  
 2. ANODE  
 3. CATHODE  
 4. CATHODE  
 5. ANODE  
 6. CATHODE

**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

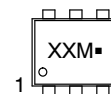
**STYLE 11:**  
 PIN 1. EMITTER 2  
 2. BASE 2  
 3. COLLECTOR 1  
 4. EMITTER 1  
 5. BASE 1  
 6. COLLECTOR 2



**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.

**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 1.60x1.20x0.55, 0.50P</b>	<b>PAGE 1 OF 1</b>

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