

Small Signal MOSFET

20 V, 220 mA / -200 mA, Complementary,
1.0 x 1.0 mm SOT-963 Package

Features

- Complementary MOSFET Device
- Offers a Low $R_{DS(on)}$ Solution in the Ultra Small 1.0x1.0 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

- Load Switch with Level Shift
- Optimized for Power Management in Ultra Portable Equipment

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}	± 8	V
N-Channel 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	
P-Channel Continuous Drain Current (Note 1)	Steady State	$T_A = 25^{\circ}\text{C}$		-200	
		$T_A = 85^{\circ}\text{C}$		-140	
	$t \leq 5 \text{ s}$	$T_A = 25^{\circ}\text{C}$		-250	
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	N-Channel	$t_p = 10 \mu\text{s}$	I_{DM}	800	mA
	P-Channel			-600	
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 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 the minimum recommended pad size, 1 oz. Cu.
2. Pulse Test: pulse width $\leq 300 \mu\text{s}$, duty cycle $\leq 2\%$

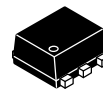
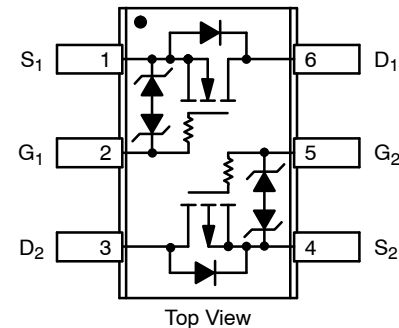


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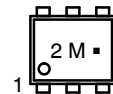
$V_{(BR)DSS}$	$R_{DS(on)}$ Max	I_D Max
N-Channel 20 V	1.5 Ω @ 4.5 V	0.22 A
	2.0 Ω @ 2.5 V	
	3.0 Ω @ 1.8 V	
	4.5 Ω @ 1.5 V	
P-Channel 20 V	5.0 Ω @ -4.5 V	-0.2 A
	6.0 Ω @ -2.5 V	
	7.0 Ω @ -1.8 V	
	10 Ω @ -1.5 V	

PINOUT: SOT-963



SOT-963
CASE 527AD

MARKING DIAGRAM



- 2 = Specific Device Code
- M = Date Code
- = Pb-Free Package

ORDERING INFORMATION

Device	Package	Shipping†
NTUD3169CZT5G	SOT-963 (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.

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热阻 R_{θJA} 和 R_{θJA} 的额定值

Parameter	Symbol	Max	Unit
Junction-to-Ambient – Steady State, Minimum Pad (Note 3)	R _{θJA}	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°C unless otherwise specified)

Parameter	Symbol	N/P	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	V _{(BR)DSS}	N	V _{GS} = 0 V	I _D = 250 μA	20		V
		P		I _D = -250 μA	-20		
Zero Gate Voltage Drain Current	I _{DSS}	N	V _{GS} = 0 V, V _{DS} = 5.0 V	T _J = 25°C		50	nA
				T _J = 85°C		200	
		P	V _{GS} = 0 V, V _{DS} = -5.0 V	T _J = 25°C		-50	
				T _J = 85°C		-200	
Zero Gate Voltage Drain Current	I _{DSS}	N	V _{GS} = 0 V, V _{DS} = 16 V	T _J = 25°C		100	nA
		P	V _{GS} = 0 V, V _{DS} = -16 V			-100	
Gate-to-Source Leakage Current	I _{GSS}	N	V _{DS} = 0 V, V _{GS} = ±5.0 V			±100	nA
		P				±100	

ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	V _{GS(TH)}	N	V _{GS} = V _{DS}	I _D = 250 μA	0.4	1.0	V
		P		I _D = -250 μA	-0.4	-1.0	
Drain-to-Source On Resistance	R _{DS(on)}	N	V _{GS} = 4.5 V, I _D = 100 mA		0.75	1.5	Ω
		P	V _{GS} = -4.5 V, I _D = -100 mA		2.0	5.0	
		N	V _{GS} = 2.5 V, I _D = 50 mA		1.0	2.0	
		P	V _{GS} = -2.5 V, I _D = -50 mA		2.6	6.0	
		N	V _{GS} = 1.8 V, I _D = 20 mA		1.4	3.0	
		P	V _{GS} = -1.8 V, I _D = -20 mA		3.4	7.0	
		N	V _{GS} = 1.5 V, I _D = 10 mA		1.8	4.5	
		P	V _{GS} = -1.5 V, I _D = -10 mA		4.0	10	
		N	V _{GS} = 1.2 V, I _D = 1.0 mA		2.8		
		P	V _{GS} = -1.2 V, I _D = -1.0 mA		6.0		
Forward Transconductance	g _{FS}	N	V _{DS} = 5.0 V, I _D = 125 mA		0.48		S
		P	V _{DS} = -5.0 V, I _D = -125 mA		0.35		
Source-Drain Diode Voltage	V _{SD}	N	V _{GS} = 0 V, I _S = 10 mA	T _J = 25°C	0.6	1.0	V
		P	V _{GS} = 0 V, I _S = -10 mA		-0.6	-1.0	

CAPACITANCES

Input Capacitance	C _{ISS}	N	f = 1 MHz, V _{GS} = 0 V V _{DS} = 15 V	12.5		pF
Output Capacitance	C _{OSS}			3.6		
Reverse Transfer Capacitance	C _{RSS}			2.6		
Input Capacitance	C _{ISS}	P	f = 1 MHz, V _{GS} = 0 V V _{DS} = -15 V	13.5		
Output Capacitance	C _{OSS}			3.8		
Reverse Transfer Capacitance	C _{RSS}			2.0		

4. Switching characteristics are independent of operating junction temperatures

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ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified)

Parameter	Symbol	N/P	Test Condition	Min	Typ	Max	Unit
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SWITCHING CHARACTERISTICS, V_{GS} = 4.5 V (Note 4)

Turn-On Delay Time	t _{d(ON)}	N	V _{GS} = 4.5 V, V _{DD} = 10 V, I _D = 200 mA, R _G = 2.0 Ω		16.5		ns
Rise Time	t _r				25.5		
Turn-Off Delay Time	t _{d(OFF)}				142		
Fall Time	t _f				80		
Turn-On Delay Time	t _{d(ON)}	P	V _{GS} = -4.5 V, V _{DD} = -15 V, I _D = -200 mA, R _G = 2.0 Ω		26		
Rise Time	t _r				46		
Turn-Off Delay Time	t _{d(OFF)}				196		
Fall Time	t _f				145		

4. Switching characteristics are independent of operating junction temperatures

TYPICAL CHARACTERISTICS (N-CHANNEL)

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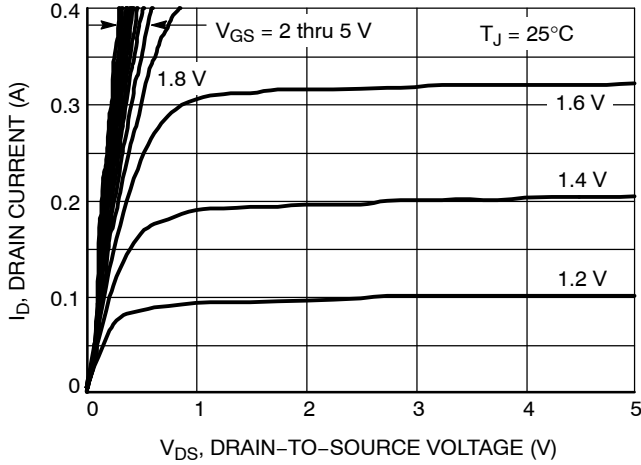


Figure 1. On-Region Characteristics

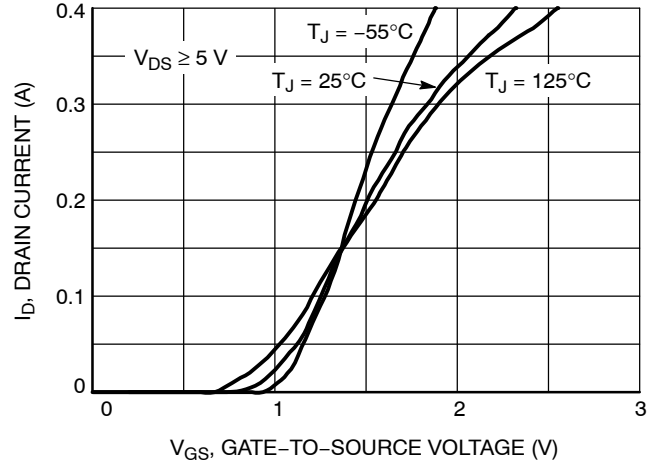


Figure 2. Transfer Characteristics

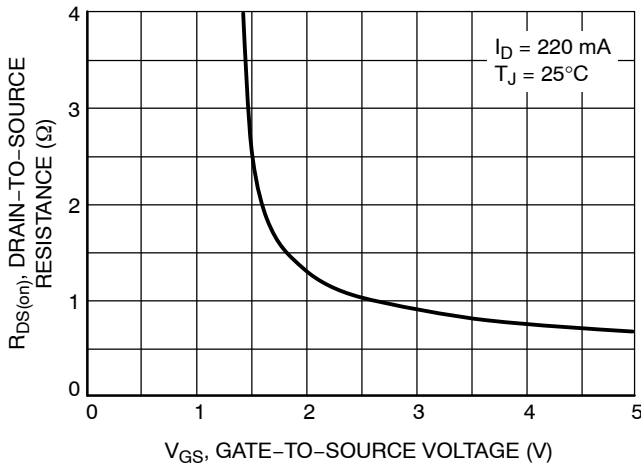


Figure 3. On-Resistance vs. Gate Voltage

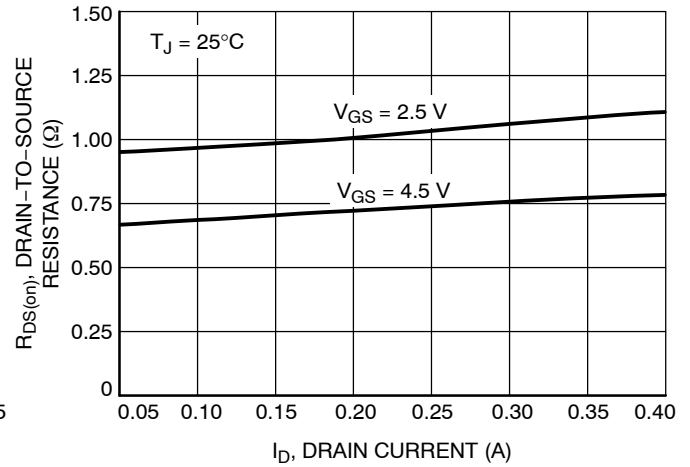


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

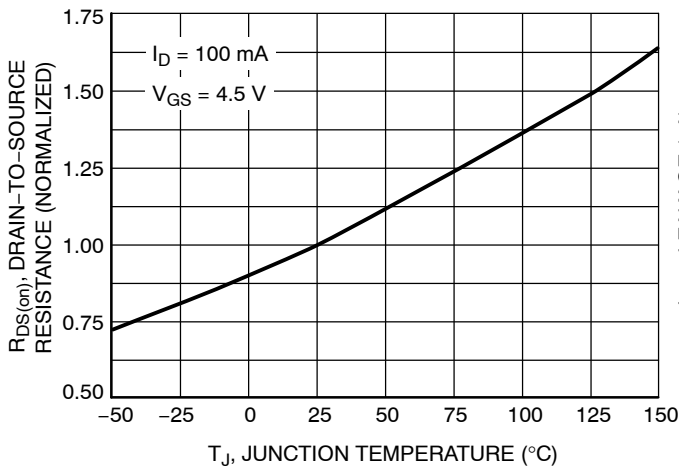


Figure 5. On-Resistance Variation with Temperature

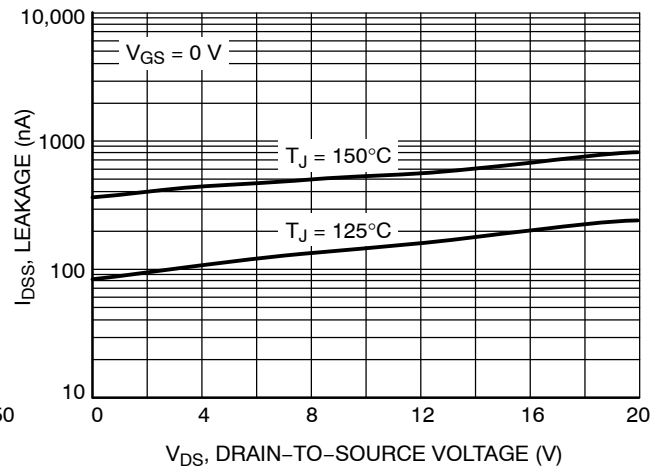


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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TYPICAL CHARACTERISTICS (N-CHANNEL)

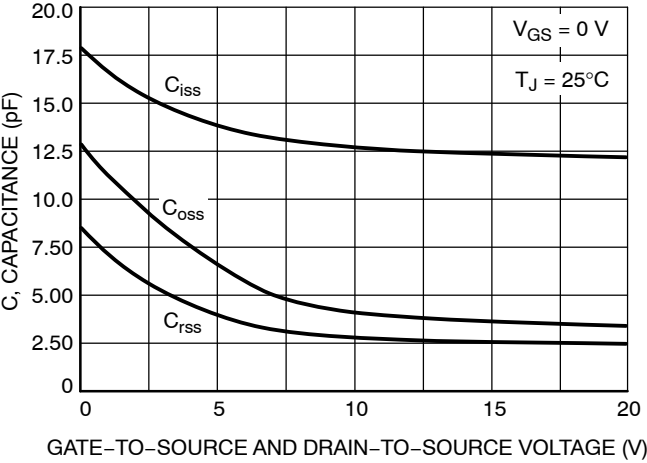


Figure 7. Capacitance Variation

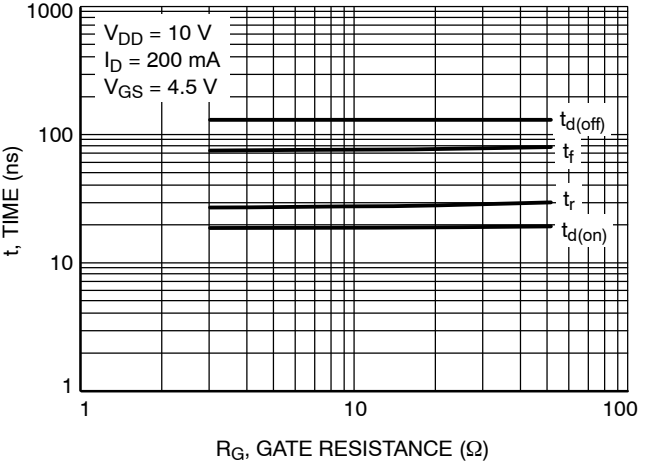


Figure 8. Resistive Switching Time Variation vs. Gate Resistance

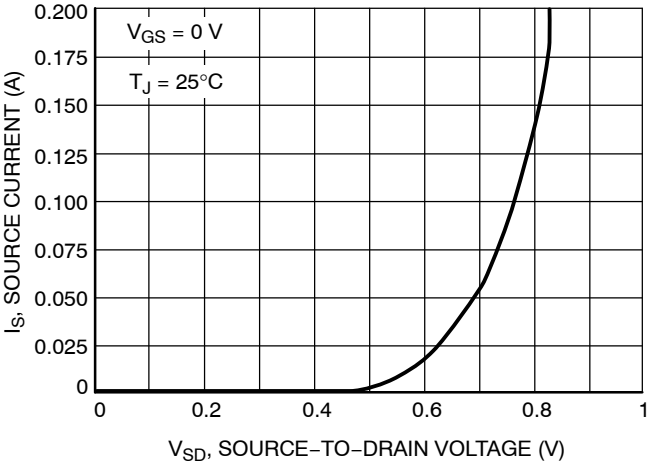


Figure 9. Diode Forward Voltage vs. Current

TYPICAL CHARACTERISTICS (P-CHANNEL)

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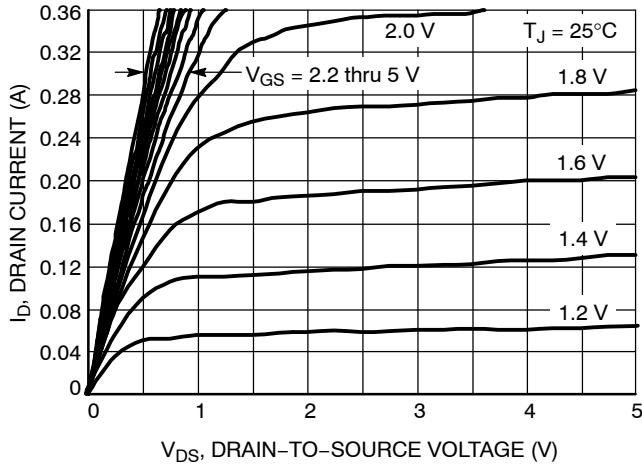


Figure 10. On-Region Characteristics

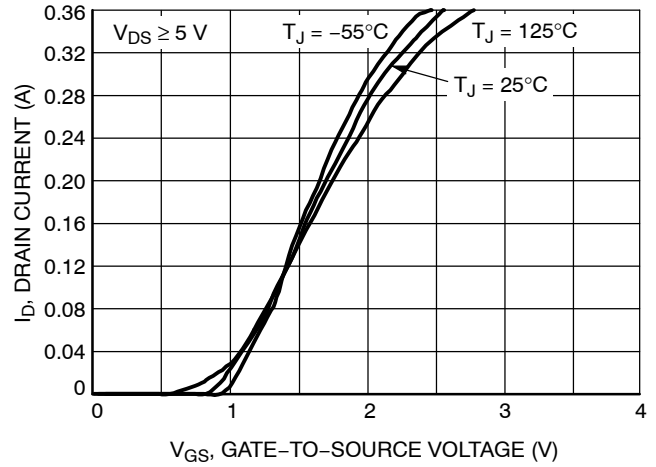


Figure 11. Transfer Characteristics

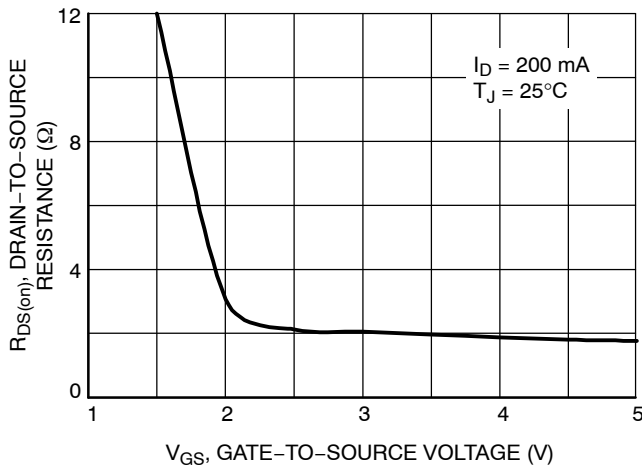


Figure 12. On-Resistance vs. Gate Voltage

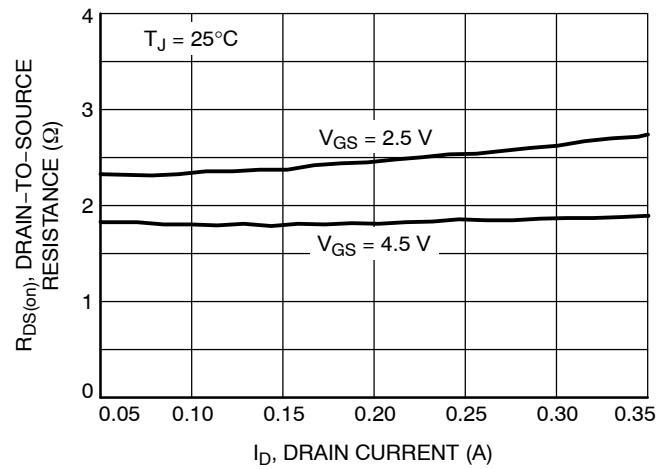


Figure 13. On-Resistance vs. Drain Current and Gate Voltage

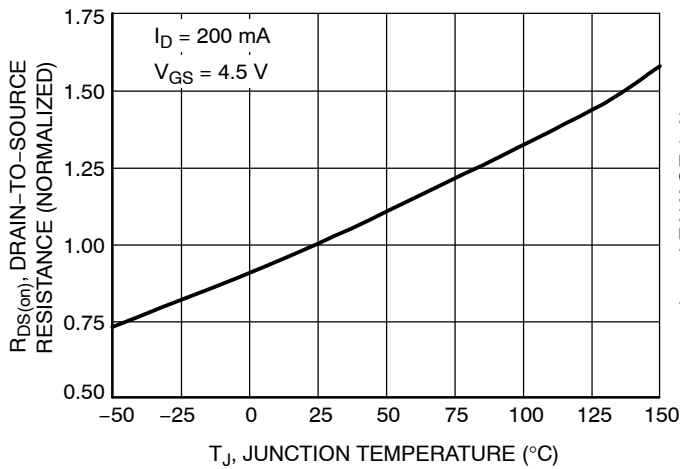


Figure 14. On-Resistance Variation with Temperature

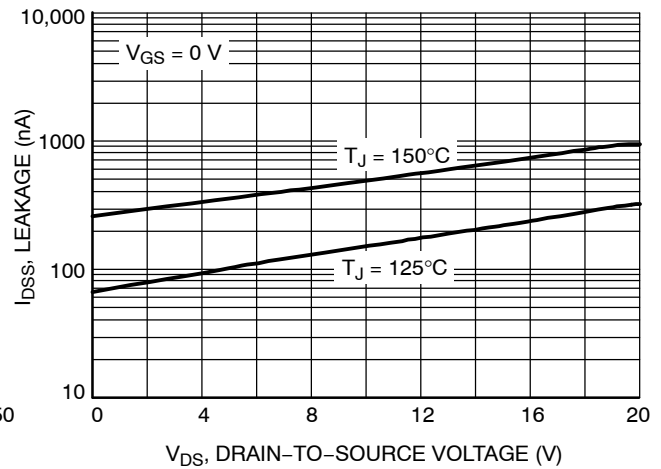


Figure 15. Drain-to-Source Leakage Current vs. Voltage

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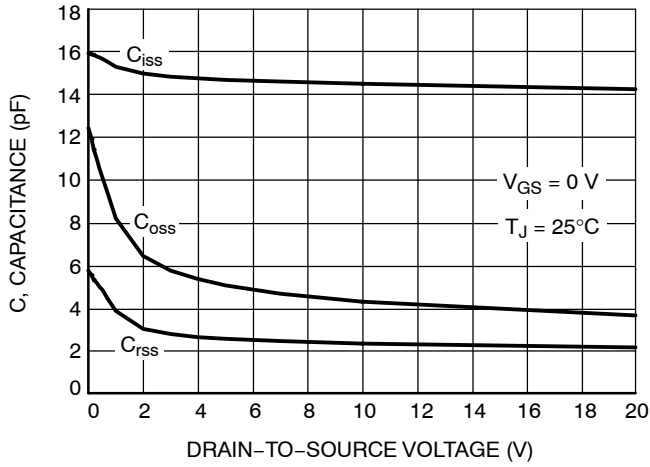


Figure 16. Capacitance Variation

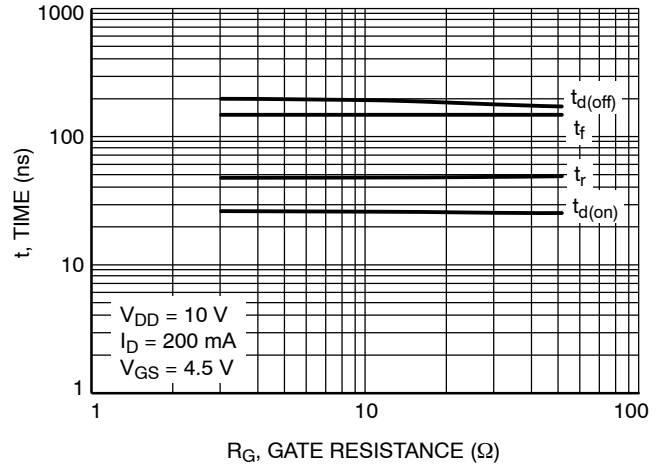


Figure 17. Resistive Switching Time Variation vs. Gate Resistance

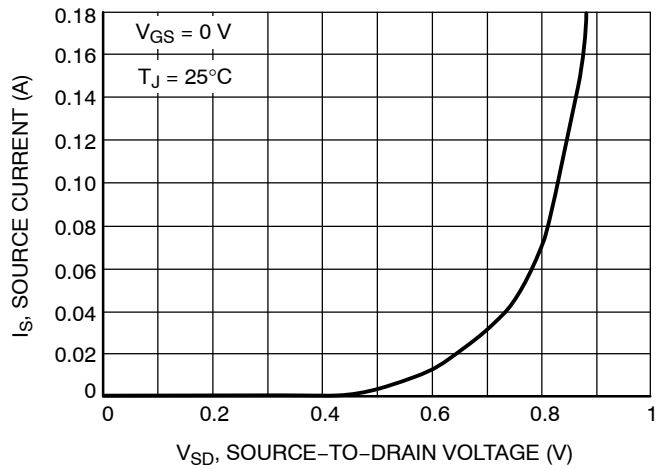


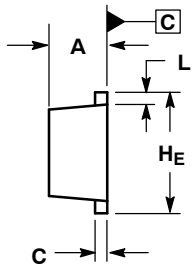
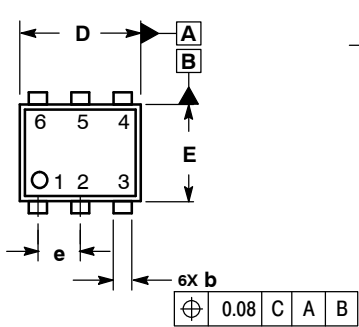
Figure 18. Diode Forward Voltage vs. Current

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PACKAGE DIMENSIONS

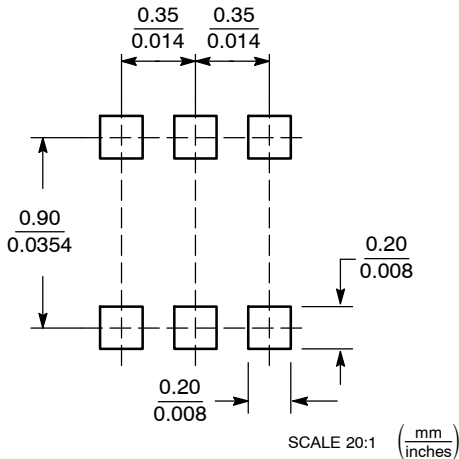
SOT-963
CASE 527AD-01
ISSUE D



- 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	0.34	0.37	0.40			
b	0.10	0.15	0.20	0.004	0.006	0.008
C	0.07	0.12	0.17	0.003	0.005	0.007
D	0.95	1.00	1.05	0.037	0.039	0.041
E	0.75	0.80	0.85	0.03	0.032	0.034
e	0.35 BSC			0.014 BSC		
L	0.05	0.10	0.15	0.002	0.004	0.006
H_E	0.95	1.00	1.05	0.037	0.039	0.041

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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