

# NTUD3127C

## Small Signal MOSFET

20 V, 200 mA / -180 mA, Complementary,  
1.0 x 1.0 mm SOT-963 Package



ON Semiconductor®

<http://onsemi.com>

### Features

- Complementary MOSFET Device
- 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.
- These are Pb-Free Devices

### 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)

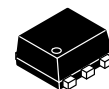
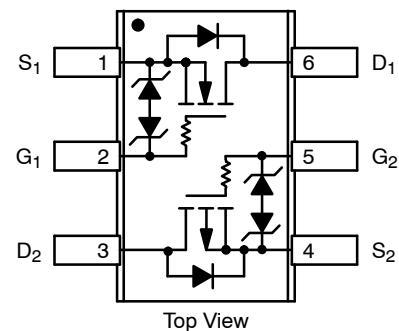
Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			$V_{DSS}$	20	V
Gate-to-Source Voltage			$V_{GS}$	$\pm 8$	V
N-Channel Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	160	mA
		$T_A = 85^\circ\text{C}$		115	
	$t \leq 5$ s	$T_A = 25^\circ\text{C}$		200	
P-Channel Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$		-140	
		$T_A = 85^\circ\text{C}$		-100	
	$t \leq 5$ s	$T_A = 25^\circ\text{C}$		-180	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	125	mW
				$t \leq 5$ s	
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  $\leq 2\%$

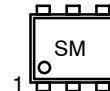
$V_{(BR)DSS}$	$R_{DS(on)}$ Max	$I_D$ Max
P-Channel -20 V	5.0 $\Omega$ @ -4.5 V	-0.18 A
	7.0 $\Omega$ @ -2.5 V	
	10 $\Omega$ @ -1.8 V	
	14 $\Omega$ @ -1.5 V	
N-Channel 20 V	3.0 $\Omega$ @ 4.5 V	0.20 A
	4.0 $\Omega$ @ 2.5 V	
	6.0 $\Omega$ @ 1.8 V	
	10 $\Omega$ @ 1.5 V	

### PINOUT: SOT-963



SOT-963  
CASE 527AA

### MARKING DIAGRAM



S = Specific Device Code  
M = Date Code

### ORDERING INFORMATION

Device	Package	Shipping†
NTUD3127CT5G	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.

# NTUD3127C

## THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Ambient – Steady State, Minimum Pad (Note 3)	$R_{\theta JA}$	1000	°C/W
Junction-to-Ambient – $t \leq 5$ s (Note 3)		600	

3. Surface-mounted on FR4 board using the minimum recommended pad size, 1 oz. Cu.

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ 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		
Zero Gate Voltage Drain Current	$I_{DSS}$	N	$V_{GS} = 0\text{ V}, V_{DS} = 5.0\text{ V}$	$T_J = 25^\circ\text{C}$		50	nA
				$T_J = 85^\circ\text{C}$		200	
		P		$T_J = 25^\circ\text{C}$		-50	
				$T_J = 85^\circ\text{C}$		-200	
Zero Gate Voltage Drain Current	$I_{DSS}$	N	$V_{GS} = 0\text{ V}, V_{DS} = 16\text{ V}$	$T_J = 25^\circ\text{C}$		100	nA
		P	$V_{GS} = 0\text{ V}, V_{DS} = -16\text{ V}$			-100	
Gate-to-Source Leakage Current	$I_{GSS}$	N	$V_{DS} = 0\text{ V}, V_{GS} = \pm 5.0\text{ V}$			100	nA
		P				-100	

## ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	$V_{GS(TH)}$	N	$V_{GS} = V_{DS}$	$I_D = 250\ \mu\text{A}$	0.4	1.0	V
		P		$I_D = -250\ \mu\text{A}$	-0.4	-1.0	
Drain-to-Source On Resistance	$R_{DS(on)}$	N	$V_{GS} = 4.5\text{ V}, I_D = 100\text{ mA}$		1.5	3.0	$\Omega$
		P	$V_{GS} = -4.5\text{ V}, I_D = -100\text{ mA}$		4.0	5.0	
		N	$V_{GS} = 2.5\text{ V}, I_D = 50\text{ mA}$		2.0	4.0	
		P	$V_{GS} = -2.5\text{ V}, I_D = -50\text{ mA}$		5.0	7.0	
		N	$V_{GS} = 1.8\text{ V}, I_D = 20\text{ mA}$		3.0	6.0	
		P	$V_{GS} = -1.8\text{ V}, I_D = -20\text{ mA}$		6.5	10	
		N	$V_{GS} = 1.5\text{ V}, I_D = 10\text{ mA}$		4.0	10	
		P	$V_{GS} = -1.5\text{ V}, I_D = -10\text{ mA}$		7.5	14	
		N	$V_{GS} = 1.2\text{ V}, I_D = 1.0\text{ mA}$		5.5		
		P	$V_{GS} = -1.2\text{ V}, I_D = -1.0\text{ mA}$		11.5		
Forward Transconductance	$g_{FS}$	N	$V_{DS} = 5.0\text{ V}, I_D = 125\text{ mA}$		0.35		S
		P	$V_{DS} = -5.0\text{ V}, I_D = -125\text{ mA}$		0.26		

## CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	$C_{ISS}$	N	$f = 1\text{ MHz}, V_{GS} = 0\text{ V}$ $V_{DS} = 15\text{ V}$		9.0		pF
Output Capacitance	$C_{OSS}$				3.0		
Reverse Transfer Capacitance	$C_{RSS}$				2.2		
Input Capacitance	$C_{ISS}$	P	$f = 1\text{ MHz}, V_{GS} = 0\text{ V}$ $V_{DS} = -15\text{ V}$		12		
Output Capacitance	$C_{OSS}$				2.7		
Reverse Transfer Capacitance	$C_{RSS}$				1.0		

4. Switching characteristics are independent of operating junction temperatures

# NTUD3127C

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

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

Turn-On Delay Time	$t_{d(ON)}$	N	$V_{GS} = 4.5\text{ V}, V_{DD} = 10\text{ V}, I_D = 200\text{ mA}, R_G = 2.0\ \Omega$		15		ns
Rise Time	$t_r$				24		
Turn-Off Delay Time	$t_{d(OFF)}$				90		
Fall Time	$t_f$				60		
Turn-On Delay Time	$t_{d(ON)}$	P	$V_{GS} = -4.5\text{ V}, V_{DD} = -15\text{ V}, I_D = -180\text{ mA}, R_G = 2.0\ \Omega$		20		
Rise Time	$t_r$				37		
Turn-Off Delay Time	$t_{d(OFF)}$				112		
Fall Time	$t_f$				97		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	N	$V_{GS} = 0\text{ V}, I_S = 10\text{ mA}$	$T_J = 25^\circ\text{C}$		0.60	1.0	V
		P	$V_{GS} = 0\text{ V}, I_S = -10\text{ mA}$			-0.65	-1.0	

4. Switching characteristics are independent of operating junction temperatures

TYPICAL PERFORMANCE CURVES – N-CANNEL

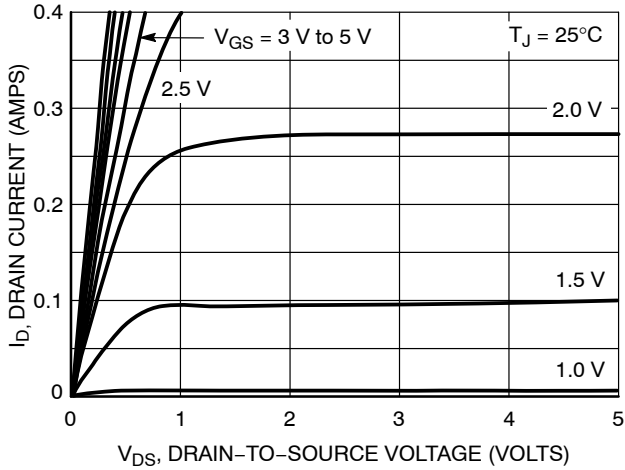


Figure 1. On-Region Characteristics

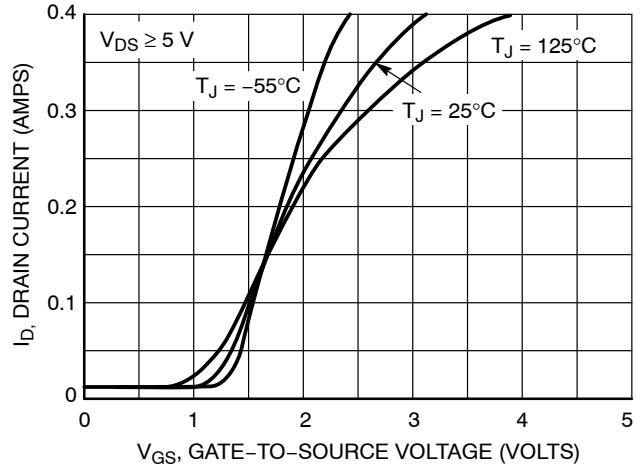


Figure 2. Transfer Characteristics

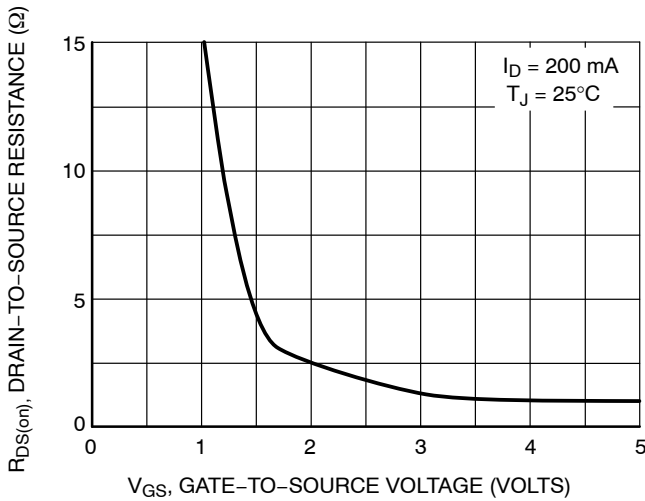


Figure 3. On-Resistance vs. Gate Voltage

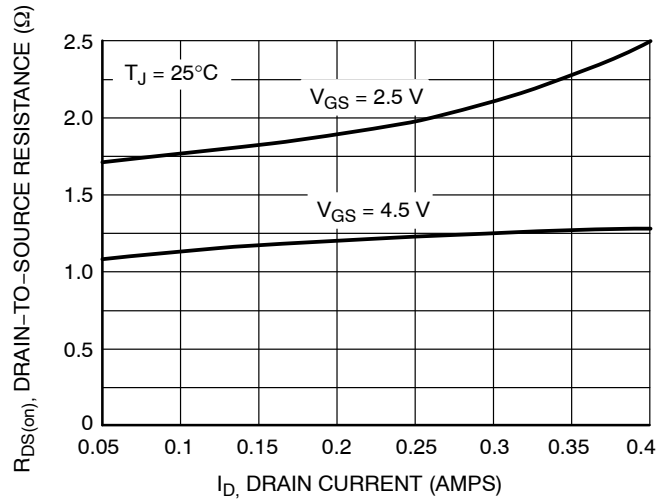


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

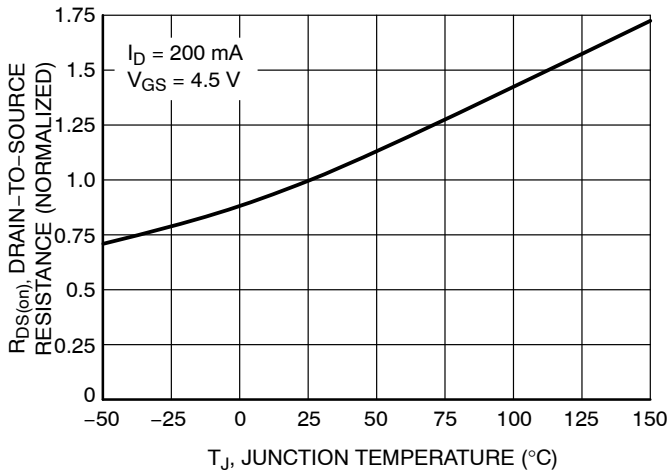


Figure 5. On-Resistance Variation with Temperature

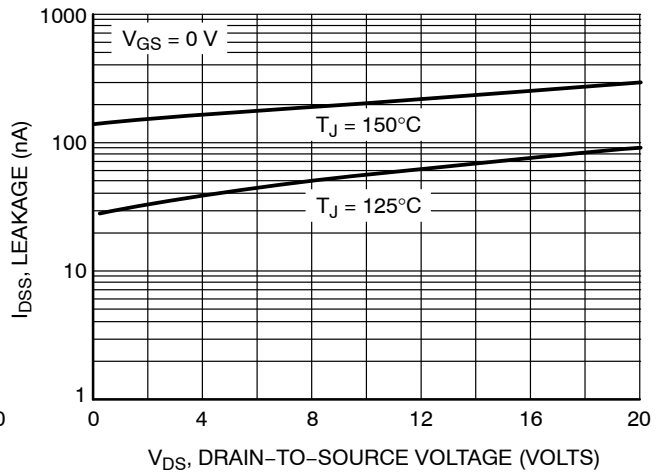


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES - N-CHANNEL

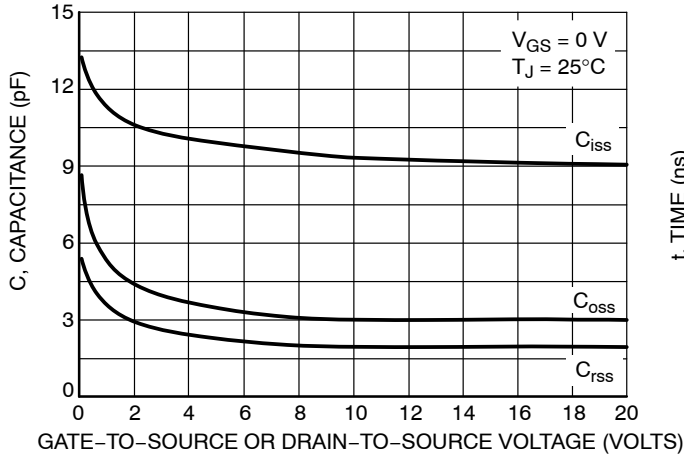


Figure 7. Capacitance Variation

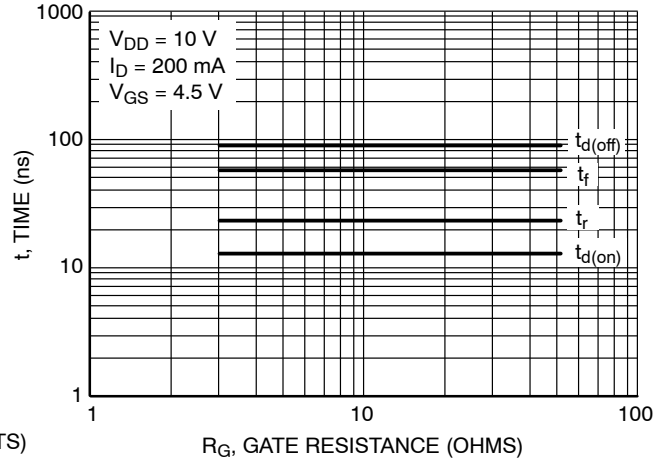


Figure 8. Resistive Switching Time Variation vs. Gate Resistance

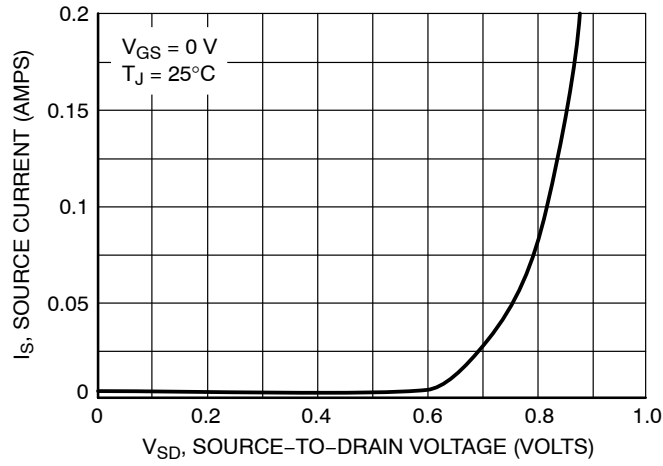


Figure 9. Diode Forward Voltage vs. Current

TYPICAL PERFORMANCE CURVES – P-CHANNEL

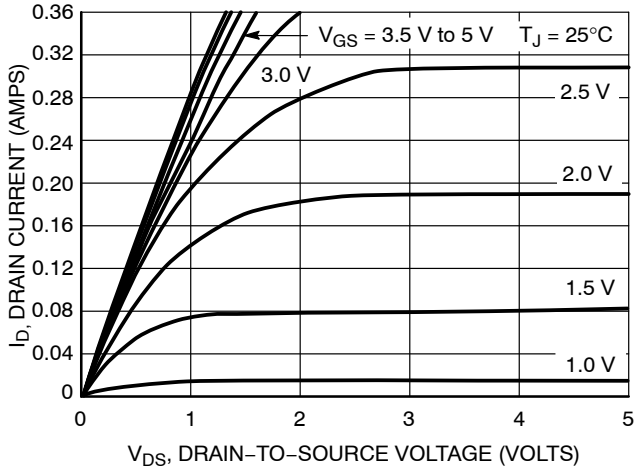


Figure 10. On-Region Characteristics

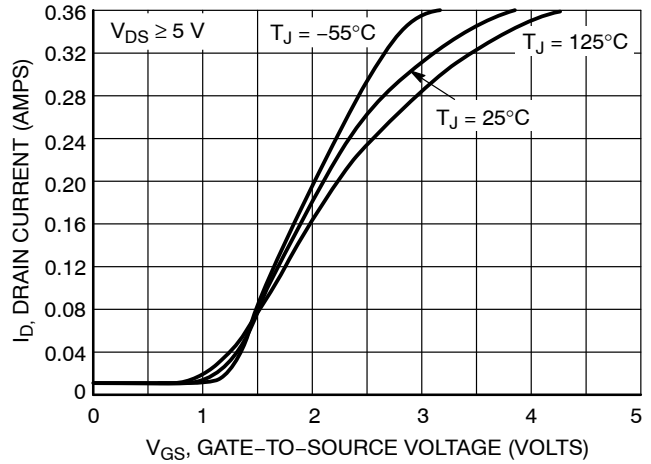


Figure 11. Transfer Characteristics

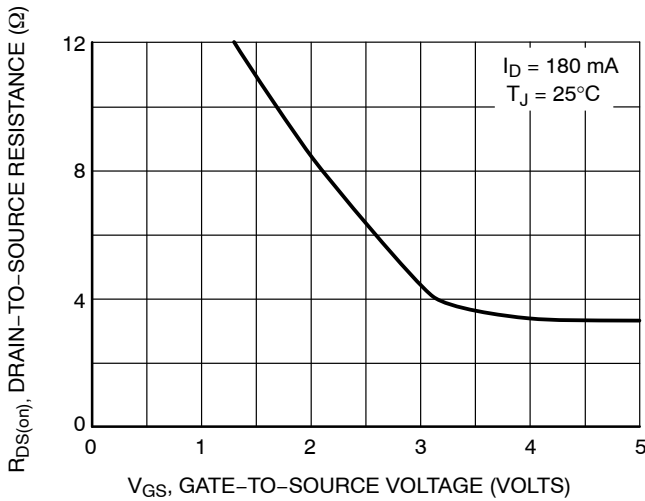


Figure 12. On-Resistance vs. Gate Voltage

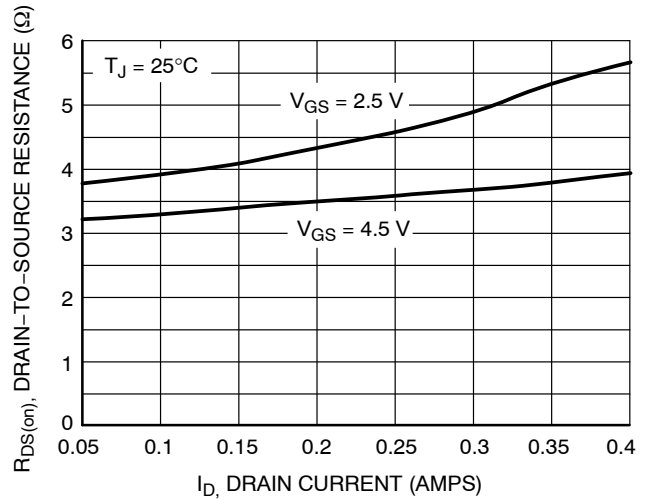


Figure 13. On-Resistance vs. Drain Current and Gate Voltage

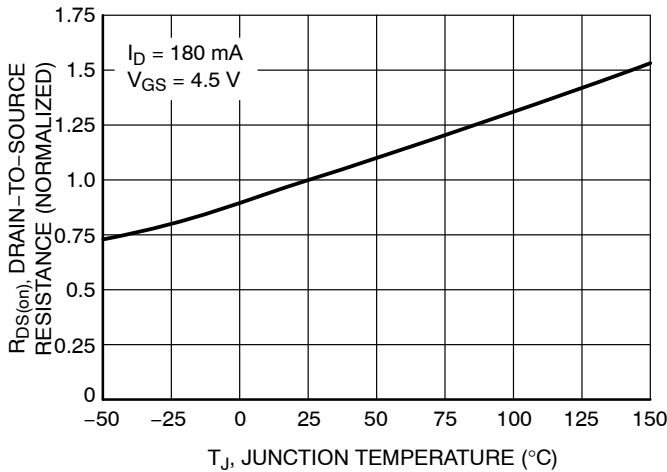


Figure 14. On-Resistance Variation with Temperature

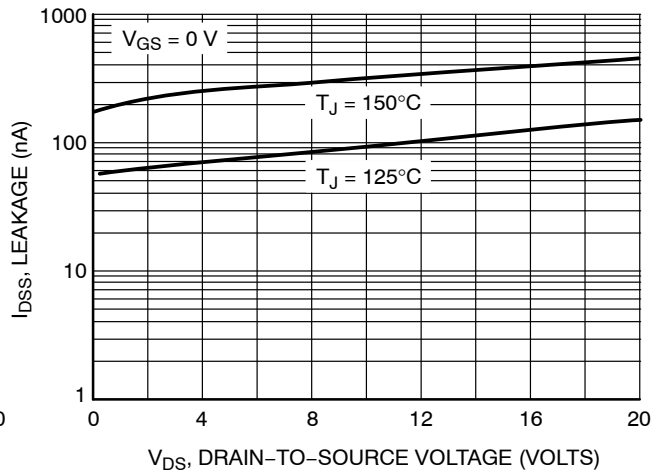


Figure 15. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES - P-CHANNEL

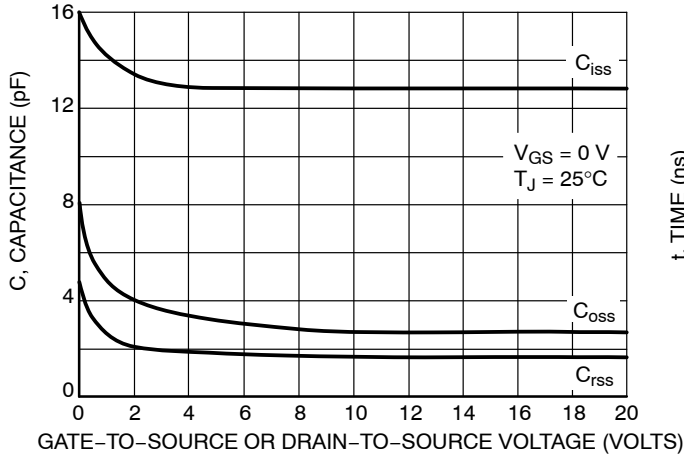


Figure 16. Capacitance Variation

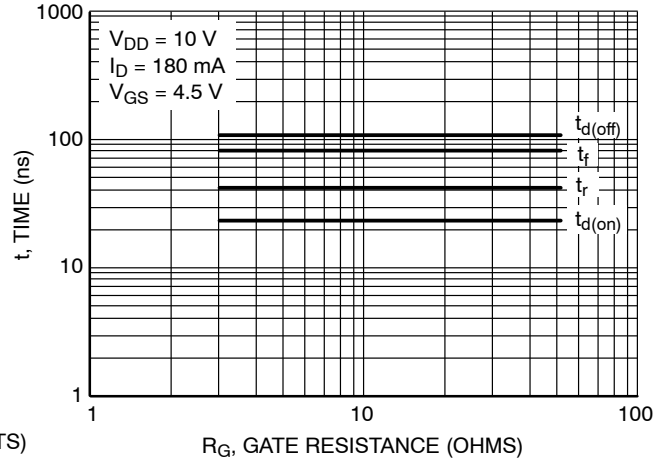


Figure 17. Resistive Switching Time Variation vs. Gate Resistance

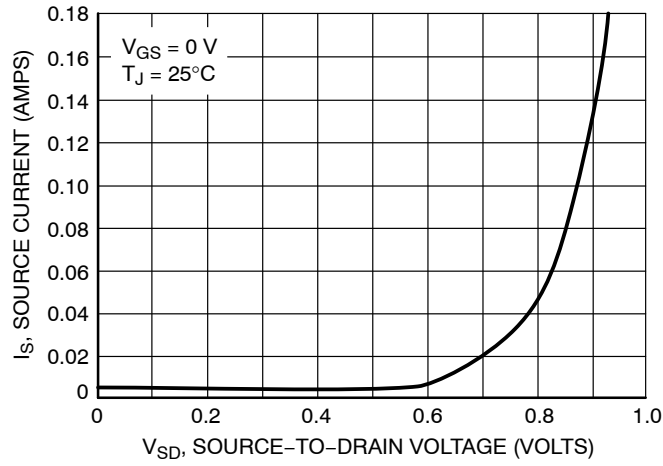


Figure 18. Diode Forward Voltage vs. Current

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

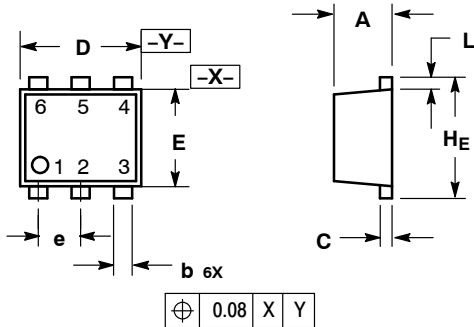
ON Semiconductor®



**SOT-963**  
CASE 527AA-01  
ISSUE D

DATE 30 JUL 2008

  
SCALE 4:1



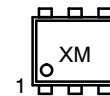
**NOTES:**

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	0.40	0.45	0.50	0.016	0.018	0.020
b	0.10	0.15	0.20	0.004	0.006	0.008
C	0.05	0.10	0.15	0.002	0.004	0.006
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 <sub>E</sub>	0.95	1.00	1.05	0.037	0.039	0.041

- |  |   |  |
|--|---|--|
| <p><b>STYLE 1:</b><br/>PIN 1. EMITTER 1<br/>2. BASE 1<br/>3. COLLECTOR 2<br/>4. EMITTER 2<br/>5. BASE 2<br/>6. COLLECTOR 1</p> | <p><b>STYLE 2:</b><br/>PIN 1. EMITTER 1<br/>2. EMITTER2<br/>3. BASE 2<br/>4. COLLECTOR 2<br/>5. BASE 1<br/>6. COLLECTOR 1</p> | <p><b>STYLE 3:</b><br/>PIN 1. CATHODE 1<br/>2. CATHODE 1<br/>3. ANODE/ANODE 2<br/>4. CATHODE 2<br/>5. CATHODE 2<br/>6. ANODE/ANODE 1</p> |
| <p><b>STYLE 4:</b><br/>PIN 1. COLLECTOR<br/>2. COLLECTOR<br/>3. BASE<br/>4. EMITTER<br/>5. COLLECTOR<br/>6. COLLECTOR</p>      | <p><b>STYLE 5:</b><br/>PIN 1. CATHODE<br/>2. CATHODE<br/>3. ANODE<br/>4. ANODE<br/>5. CATHODE<br/>6. CATHODE</p>              | <p><b>STYLE 6:</b><br/>PIN 1. CATHODE<br/>2. ANODE<br/>3. CATHODE<br/>4. CATHODE<br/>5. CATHODE<br/>6. CATHODE</p>                       |
| <p><b>STYLE 7:</b><br/>PIN 1. CATHODE<br/>2. ANODE<br/>3. CATHODE<br/>4. CATHODE<br/>5. ANODE<br/>6. CATHODE</p>               | <p><b>STYLE 8:</b><br/>PIN 1. DRAIN<br/>2. DRAIN<br/>3. GATE<br/>4. SOURCE<br/>5. DRAIN<br/>6. DRAIN</p>                      | <p><b>STYLE 9:</b><br/>PIN 1. SOURCE 1<br/>2. GATE 1<br/>3. DRAIN 2<br/>4. SOURCE 2<br/>5. GATE 2<br/>6. DRAIN 1</p>                     |
| <p><b>STYLE 10:</b><br/>PIN 1. CATHODE 1<br/>2. N/C<br/>3. CATHODE 2<br/>4. ANODE 2<br/>5. N/C<br/>6. ANODE 1</p>              |   |  |

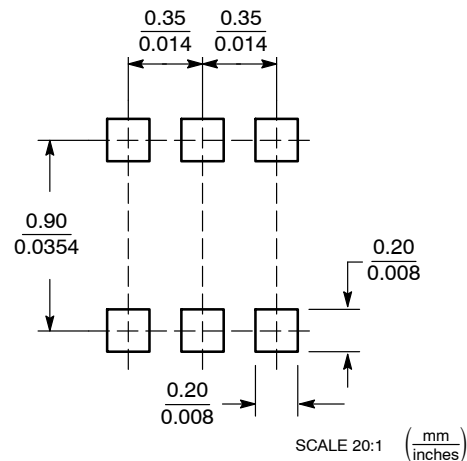
**GENERIC MARKING DIAGRAM\***



X = Specific Device Code  
M = Month Code


\*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.

**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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