

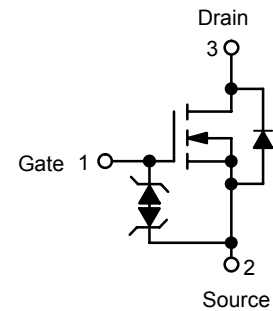
## Gate ESD Protection, N-Channel

### Features

- Low Gate Voltage Threshold( $V_{GS(th)}$ )to Facilitate Drive Circuit Design
- Low Gate Charge for Fast Switching
- ESD Protected Gate
- Minimum Breakdown Voltage Rating of 30 V
- **Pb-Free package is available**  
RoHS product for packing code suffix "G"  
Halogen free product for packing code suffix "H"

### Applications

- Level Shifters
- Level Switches
- Low Side Load Switches
- Portable Applications



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

Parameter		Symbol	Value	Unit	
Drain-to-Source Voltage		$V_{DSS}$	30	V	
Gate-to-Source Voltage		$V_{GS}$	$\pm 20$	V	
Continuous Drain Current (Note 1)	Steady State	$I_D$	$T_A = 25^\circ\text{C}$	0.5	A
			$T_A = 85^\circ\text{C}$	0.37	
Power Dissipation (Note 1)	Steady State	$P_D$	0.69	W	
Continuous Drain Current (Note 1)	$t < 10\text{ s}$	$I_D$	$T_A = 25^\circ\text{C}$	0.56	A
			$T_A = 85^\circ\text{C}$	0.40	
Power Dissipation (Note 1)	$t < 5\text{ s}$	$P_D$	0.83	W	
Pulsed Drain Current	$t_p = 10\ \mu\text{s}$	$I_{DM}$	1.7	A	
Operating Junction and Storage Temperature		$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$	
Source Current (Body Diode)		$I_S$	1.0	A	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$	

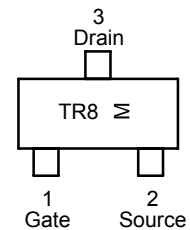
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Ambient - Steady State (Note 1)	$R_{\theta JA}$	180	$^\circ\text{C/W}$
Junction-to-Ambient - $t < 10\text{ s}$ (Note 1)	$R_{\theta JA}$	150	
Junction-to-Ambient - Steady State (Note 2)	$R_{\theta JA}$	300	

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

### MARKING DIAGRAM



TR8 = Specific Device Code  
M = Month Code

### ORDERING INFORMATION

Device	Package	Shipping
2N4003NLT1	SOT-23	3000/Tape & Reel

**Small Signal MOSFET 30V,0.56A, Single, SOT-23**

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
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**OFF CHARACTERISTICS**

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$	30			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			40		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 30\text{ V}, T_J = 25^\circ\text{C}$			1.0	$\mu\text{A}$
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 10\text{ V}$			$\pm 1.0$	$\mu\text{A}$

**ON CHARACTERISTICS** (Note 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	0.8		1.6	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			3.4		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 4.0\text{ V}, I_D = 10\text{ mA}$		1.0	1.5	$\Omega$
		$V_{GS} = 2.5\text{ V}, I_D = 10\text{ mA}$		1.5	2.0	
Forward Transconductance	$g_{FS}$	$V_{DS} = 3.0\text{ V}, I_D = 10\text{ mA}$		0.33		S

**CHARGES AND CAPACITANCES**

Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 5.0\text{ V}$		21		pF
Output Capacitance	$C_{oss}$			19.7		
Reverse Transfer Capacitance	$C_{rss}$			8.1		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 5.0\text{ V}, V_{DS} = 24\text{ V}, I_D = 0.1\text{ A}$		1.15		nC
Threshold Gate Charge	$Q_{G(TH)}$			0.15		
Gate-to-Source Gate Charge	$Q_{GS}$			0.32		
Gate-to-Drain Charge	$Q_{GD}$			0.23		

**SWITCHING CHARACTERISTICS** (Note 4)

Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 4.5\text{ V}, V_{DD} = 5.0\text{ V}, I_D = 0.1\text{ A}, R_G = 50\ \Omega$		16.7		ns
Rise Time	$t_r$			47.9		
Turn-Off Delay Time	$t_{d(off)}$			65.1		
Fall Time	$t_f$			64.2		

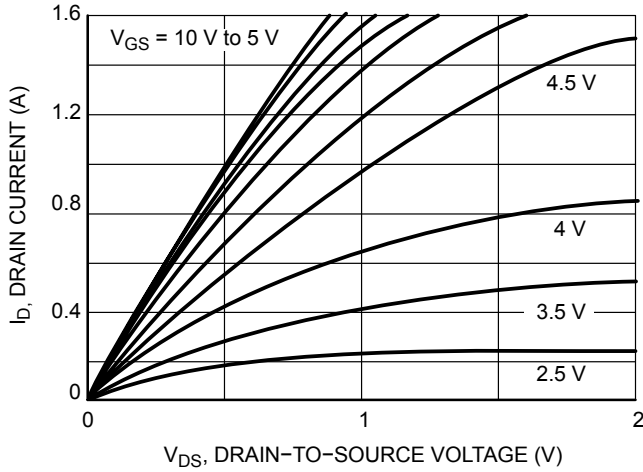
**SOURCE-DRAIN DIODE CHARACTERISTICS**

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 10\text{ mA}$	$T_J = 25^\circ\text{C}$		0.65	0.7	V
			$T_J = 125^\circ\text{C}$		0.45		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, di_S/dt = 8\text{ A}/\mu\text{s}, I_S = 10\text{ mA}$		14		ns	

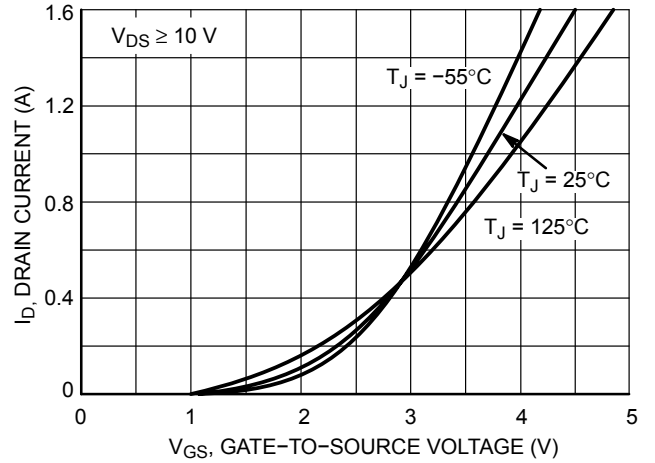
- Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Switching characteristics are independent of operating junction temperatures.

**Small Signal MOSFET 30V,0.56A, Single, SOT-23**

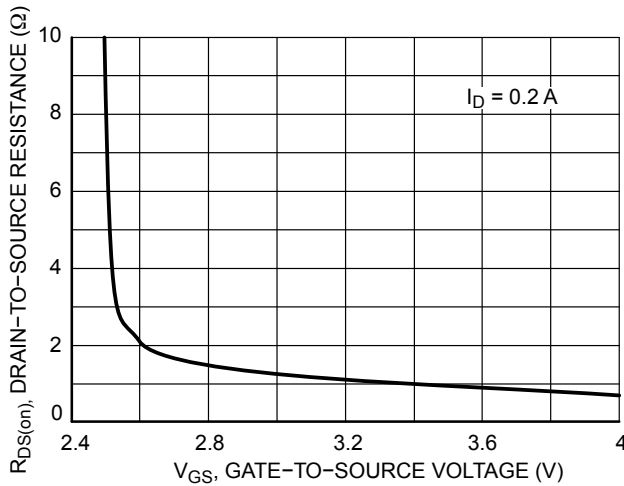
**TYPICAL PERFORMANCE CURVES** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)



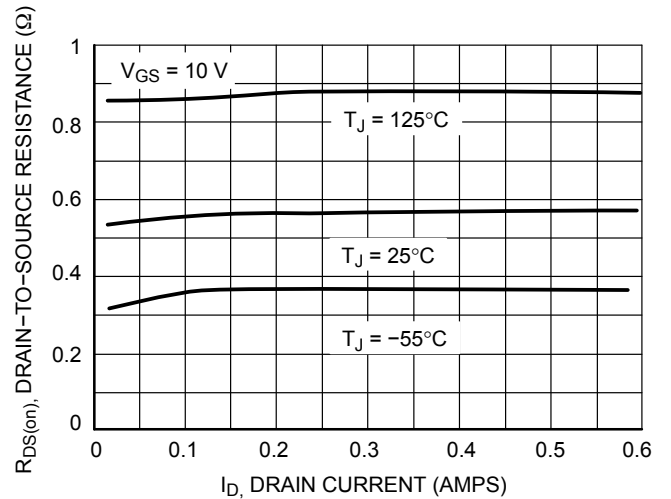
**Figure 1. On-Region Characteristics**



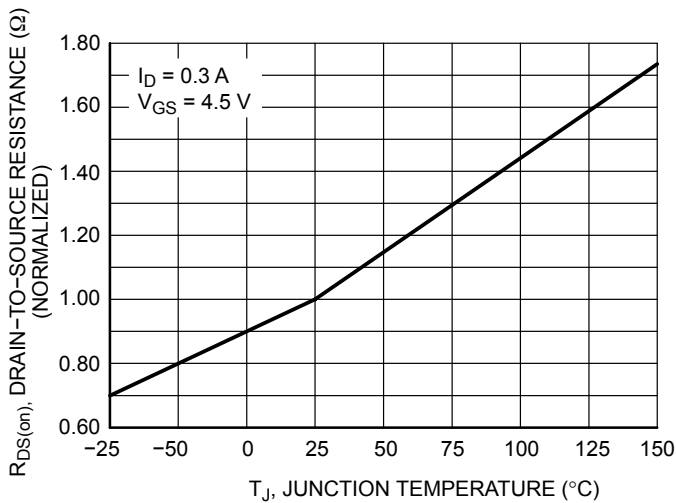
**Figure 2. Transfer Characteristics**



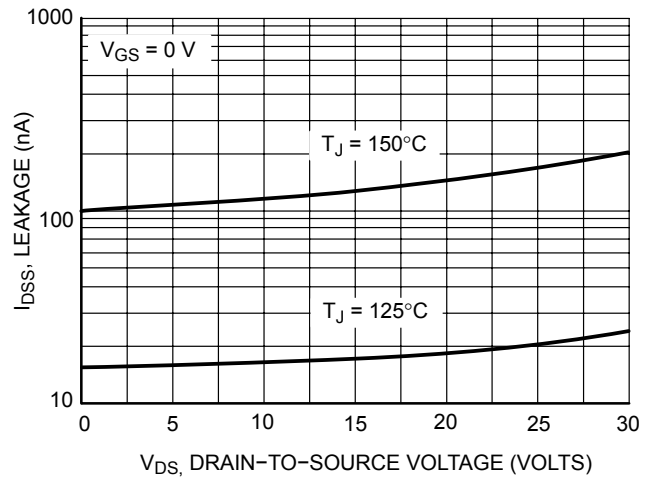
**Figure 3. On-Resistance vs. Gate-to-Source Voltage**



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

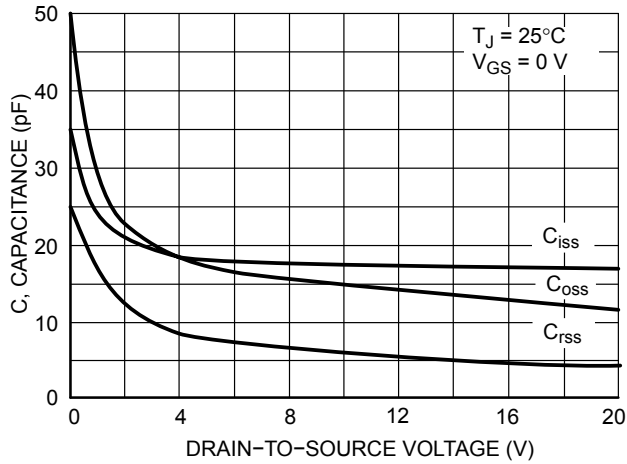


**Figure 5. On-Resistance Variation with Temperature**

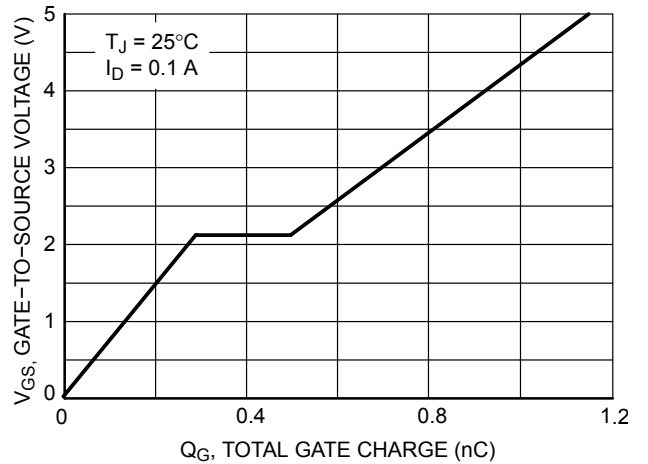


**Figure 6. Drain-to-Source Leakage Current vs. Voltage**

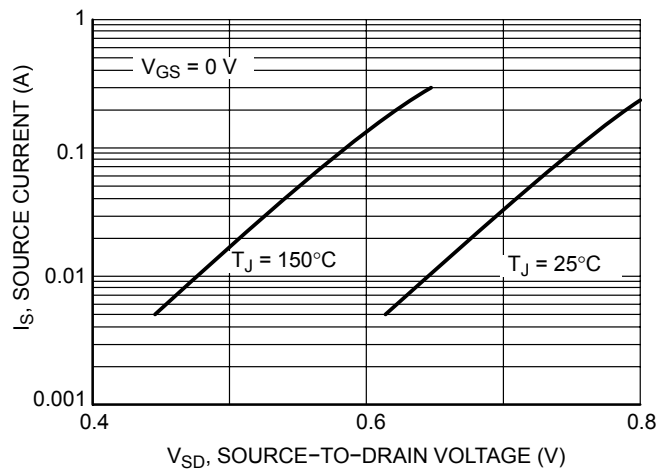
**TYPICAL PERFORMANCE CURVES** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)



**Figure 7. Capacitance Variation**

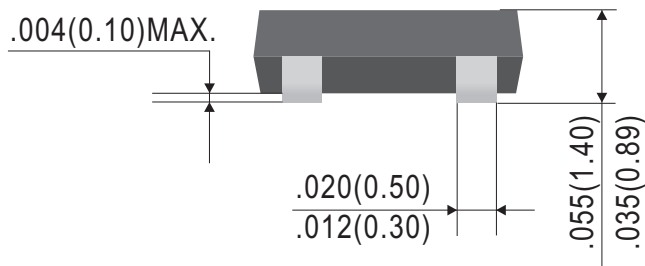
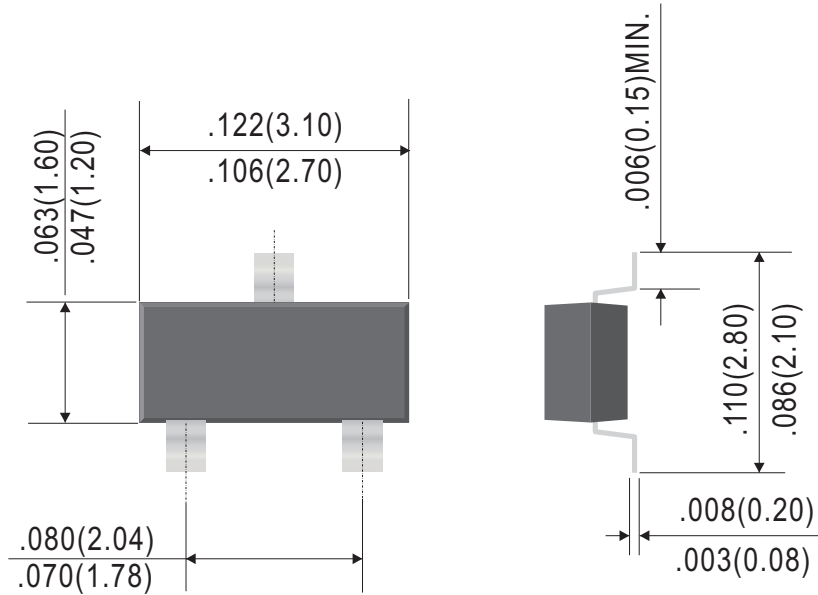


**Figure 8. Gate-to-Source & Drain-to-Source Voltage vs. Total Charge**



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

**SOT-23**



Dimensions in inches and (millimeters)

