

# NTJD4158C

## Small Signal MOSFET

30 V/-20 V, +0.25/-0.88 A,  
Complementary, SC-88

### Features

- Leading 20 V Trench for Low  $R_{DS(on)}$  Performance
- ESD Protected Gate
- SC-88 Package for Small Footprint (2 x 2 mm)

### Applications

- DC-DC Conversion
- Load/Power Management
- Load Switch
- Cell Phones, MP3s, Digital Cameras, PDAs
- This is a Pb-Free Device

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

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage	N-Ch	$V_{DSS}$	30	V
	P-Ch		-20	
Gate-to-Source Voltage	N-Ch	$V_{GS}$	$\pm 20$	V
	P-Ch		$\pm 12$	
N-Channel Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	0.25	A
		$T_A = 85^\circ\text{C}$	0.18	
P-Channel Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	-0.88	
		$T_A = 85^\circ\text{C}$	-0.63	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	0.27 W
Pulsed Drain Current	N-Ch	$t_p = 10 \mu\text{s}$	$I_{DM}$	0.5 A
	P-Ch			-3.0
Operating Junction and Storage Temperature		$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$
Source Current (Body Diode)	N-Ch	$I_S$	0.25	A
	P-Ch		-0.48	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Ambient - Steady State (Note 1)	$R_{\theta JA}$	460	$^\circ\text{C/W}$

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



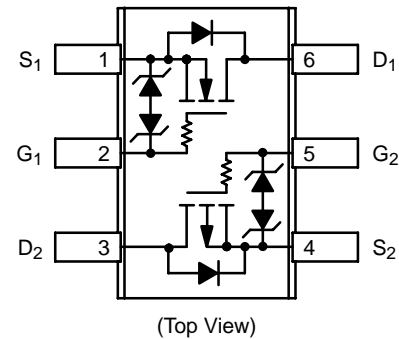
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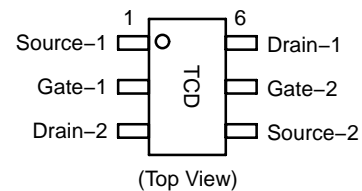
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ MAX
N-Ch 30 V	1.0 $\Omega$ @ 4.5 V	0.25 A
	1.5 m $\Omega$ @ 2.5 V	
P-Ch -20 V	215 m $\Omega$ @ -4.5 V	-0.88 A
	345 m $\Omega$ @ -2.5 V	

SC-88 (SOT-363)  
(6-Leads)



SC-88 (SOT-363)  
CASE 419B  
STYLE 26

### MARKING DIAGRAM & PIN ASSIGNMENT



TC = Specific Device Code  
D = Date Code

### ORDERING INFORMATION

Device	Package	Shipping†
NTJD4158CT1G	SC-88 (Pb-Free)	3000 Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

# NTJD4158C

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

Parameter	Symbol	N/P	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS (Note 3)

Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	N	V <sub>GS</sub> = 0 V	I <sub>D</sub> = 250 μA	30		V
		P		I <sub>D</sub> = -250 μA	-20		
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>	N			33		mV/°C
		P			-9.0		
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	N	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 30 V	T <sub>J</sub> = 25°C		1.0	μA
		P	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = -16 V			1.0	
		N	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 30 V	T <sub>J</sub> = 125°C		0.5	
		P	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = -16 V			0.5	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	N	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = 10 V			1.0	μA
		P	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = -4.5 V			1.0	

### ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	N	V <sub>GS</sub> = V <sub>DS</sub>	I <sub>D</sub> = 100 μA	0.8	1.2	1.5	V
		P		I <sub>D</sub> = -250 μA	-0.45			
Negative Gate Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>	N				3.2		mV/°C
		P				-2.7		
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	N	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 10 mA			1.0	1.5	Ω
		P	V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -0.88 A			0.215	0.260	
		N	V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 10 mA			1.5	2.5	
		P	V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -0.71 A			0.345	0.500	
Forward Transconductance	g <sub>FS</sub>	N	V <sub>DS</sub> = 3.0 V, I <sub>D</sub> = 10 mA			0.08		S
		P	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -0.88 A			3.0		

### CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	C <sub>ISS</sub>	N	f = 1 MHz, V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 5.0 V		20	33	pF	
		P		V <sub>DS</sub> = -20 V		155	225		
Output Capacitance	C <sub>OSS</sub>	N		V <sub>DS</sub> = 5.0 V		19	32		
		P		V <sub>DS</sub> = -20 V		25	40		
Reverse Transfer Capacitance	C <sub>RSS</sub>	N		V <sub>DS</sub> = 5.0 V		7.25	12		
		P		V <sub>DS</sub> = -20 V		18	30		
Total Gate Charge	Q <sub>G(TOT)</sub>	N		V <sub>GS</sub> = 5.0 V, V <sub>DS</sub> = 24 V, I <sub>D</sub> = 0.1 A		0.9	1.5		nC
		P		V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -10 V, I <sub>D</sub> = -0.88 A		2.2	3.5		
Threshold Gate Charge	Q <sub>G(TH)</sub>	N		V <sub>GS</sub> = 5.0 V, V <sub>DS</sub> = 24 V, I <sub>D</sub> = 0.1 A		0.2			
		P		V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -10 V, I <sub>D</sub> = -0.88 A		0.2			
Gate-to-Source Charge	Q <sub>GS</sub>	N	V <sub>GS</sub> = 5.0 V, V <sub>DS</sub> = 24 V, I <sub>D</sub> = 0.1 A		0.3				
		P	V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -10 V, I <sub>D</sub> = -0.88 A		0.5				
Gate-to-Drain Charge	Q <sub>GD</sub>	N	V <sub>GS</sub> = 5.0 V, V <sub>DS</sub> = 24 V, I <sub>D</sub> = 0.1 A		0.2				
		P	V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -10 V, I <sub>D</sub> = -0.88 A		0.65				

### SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	t <sub>d(ON)</sub>	N	V <sub>GS</sub> = 4.5 V, V <sub>DD</sub> = 5.0 V, I <sub>D</sub> = 250 mA, R <sub>G</sub> = 50 Ω		15		ns	
Rise Time	t <sub>r</sub>				66			
Turn-Off Delay Time	t <sub>d(OFF)</sub>				56			
Fall Time	t <sub>f</sub>				78			
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> = -0.5 A, R <sub>G</sub> = 20 Ω		5.8		
Rise Time	t <sub>r</sub>					6.5		
Turn-Off Delay Time	t <sub>d(OFF)</sub>					13.5		
Fall Time	t <sub>f</sub>					3.5		

### 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> = 10 mA	0.65	0.7	V
		P		I <sub>S</sub> = -0.48 A	-0.8	-1.2	
		N	V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125°C	I <sub>S</sub> = 10 mA	0.45		
		P		I <sub>S</sub> = -0.48 A	-0.66		
Reverse Recovery Time	t <sub>RR</sub>	N	V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 8.0 A/μs	I <sub>S</sub> = 10 mA	12.4		ns
		P	V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs	I <sub>S</sub> = -0.48 mA	TBD		

2. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
3. Switching characteristics are independent of operating junction temperatures.

# NTJD4158C

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

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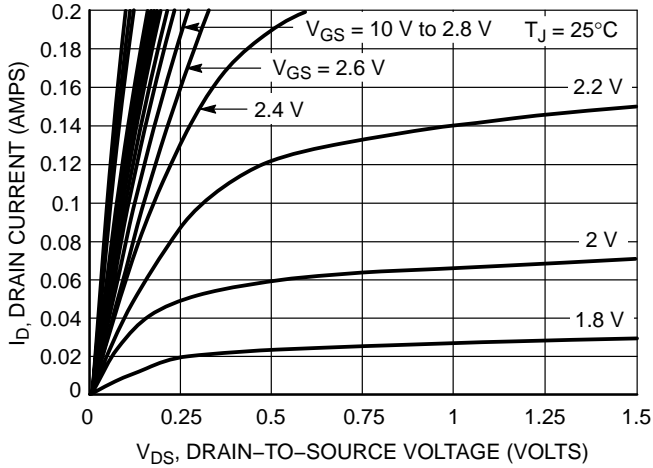


Figure 1. On-Region Characteristics

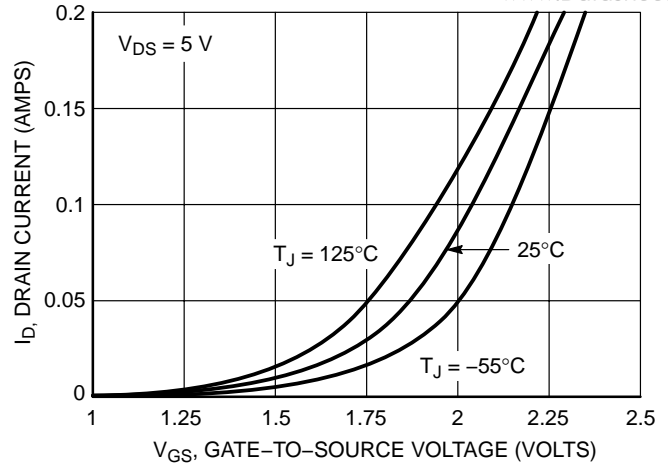


Figure 2. Transfer Characteristics

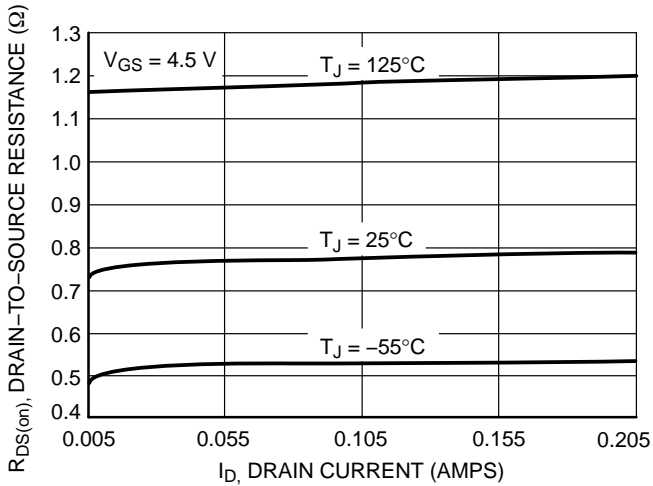


Figure 3. On-Resistance vs. Drain Current and Temperature

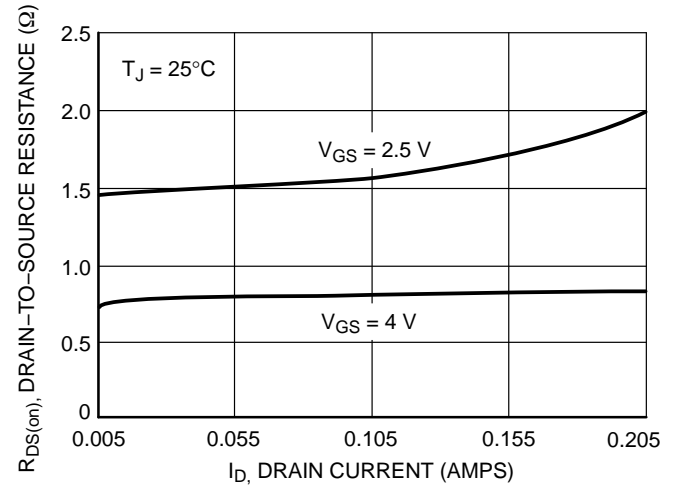


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

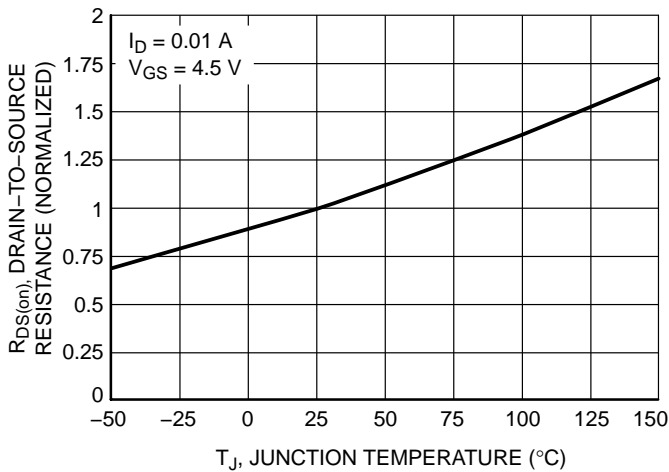


Figure 5. On-Resistance Variation with Temperature

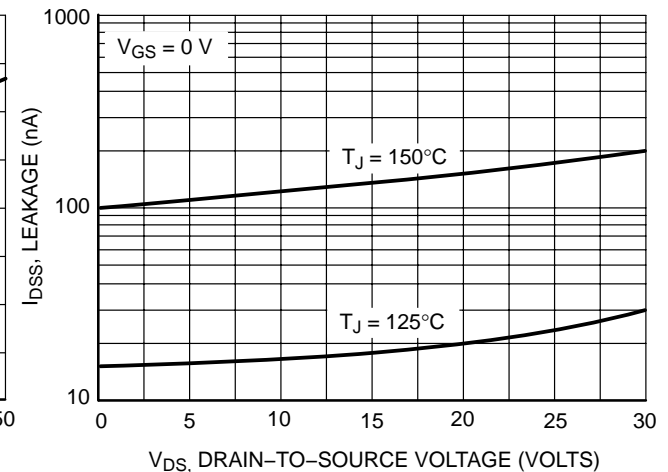


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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

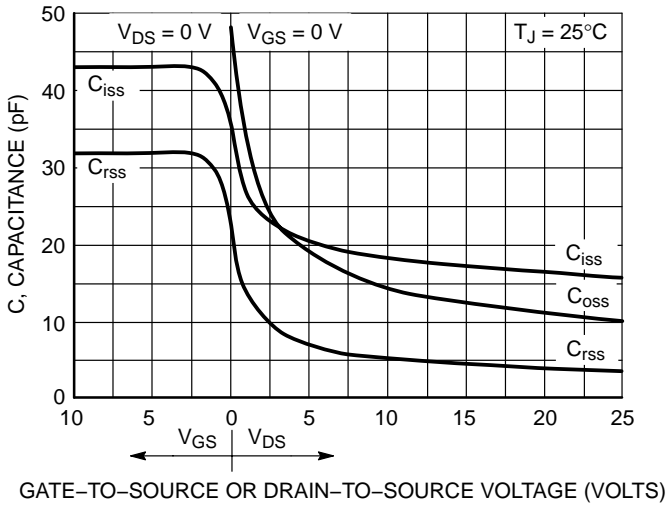


Figure 7. Capacitance Variation

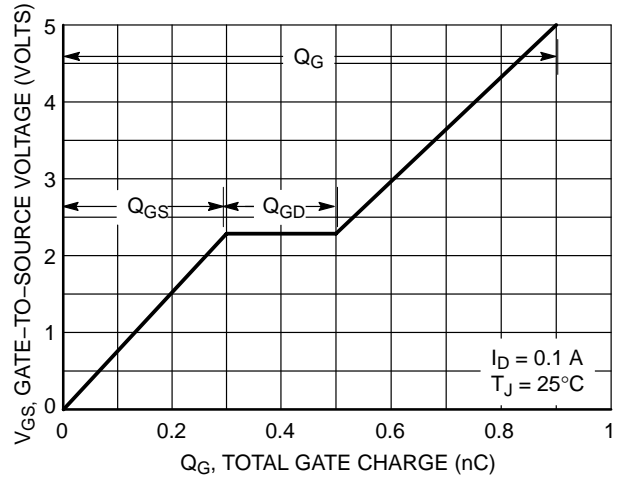


Figure 8. Gate-to-Source Voltage vs. Total Gate Charge

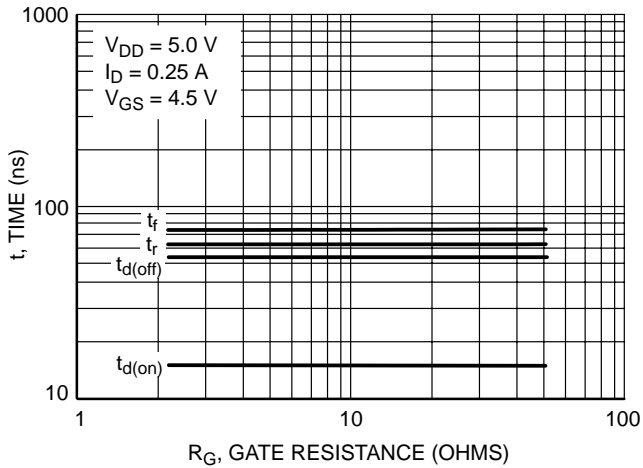


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

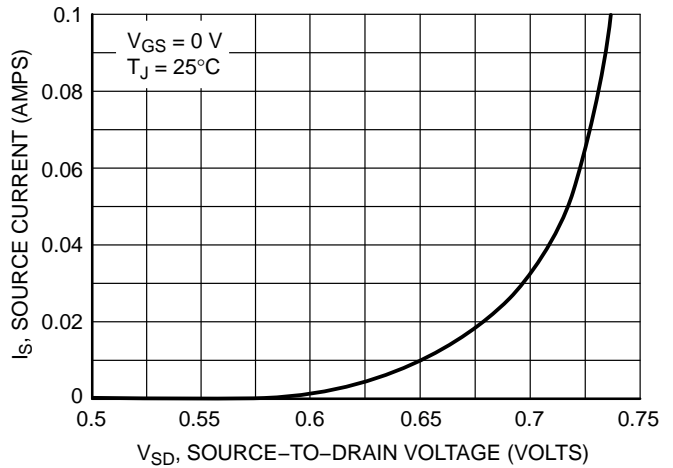


Figure 10. Diode Forward Voltage vs. Current

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

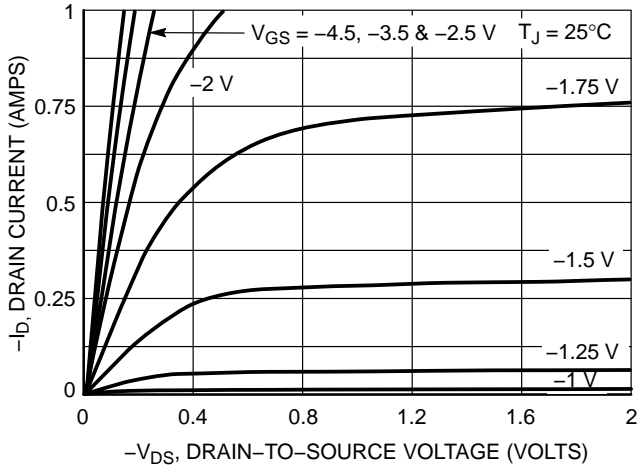


Figure 1. On-Region Characteristics

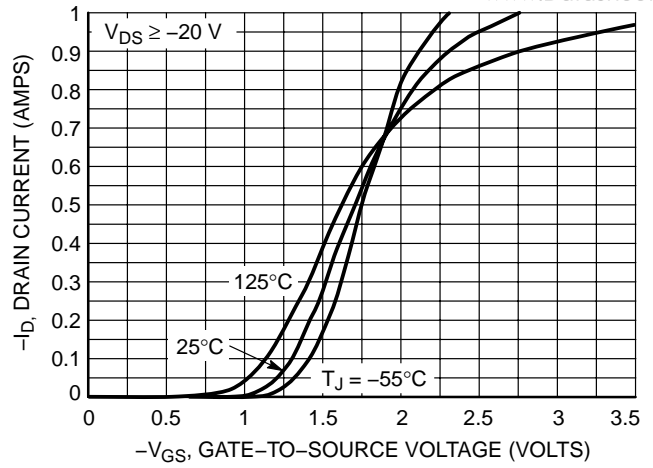


Figure 2. Transfer Characteristics

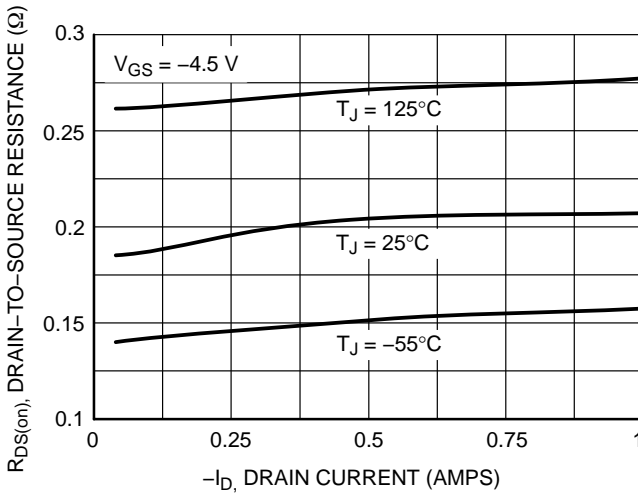


Figure 3. On-Resistance vs. Drain Current and Temperature

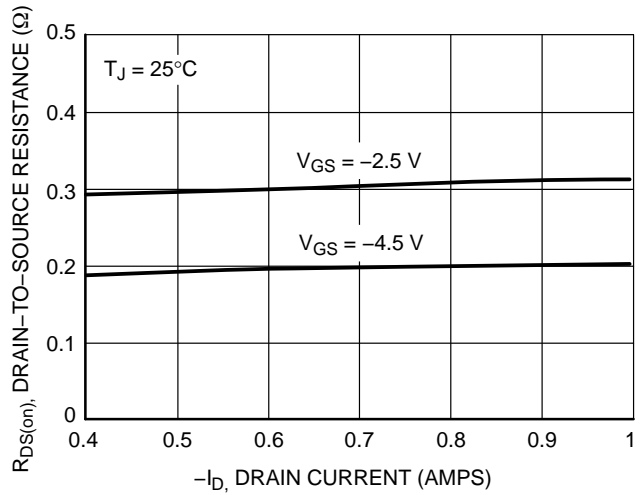


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

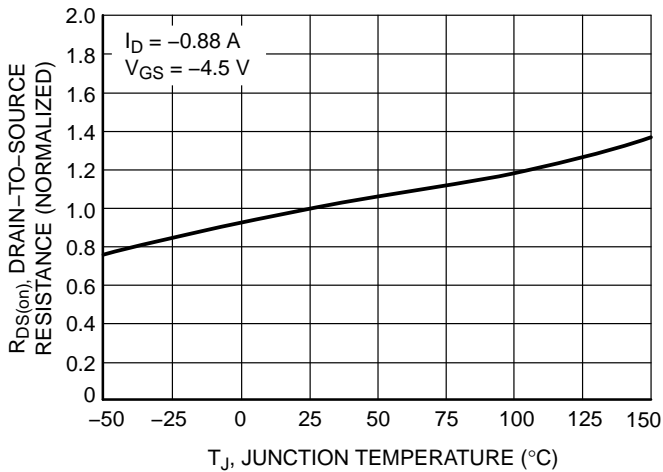


Figure 5. On-Resistance Variation with Temperature

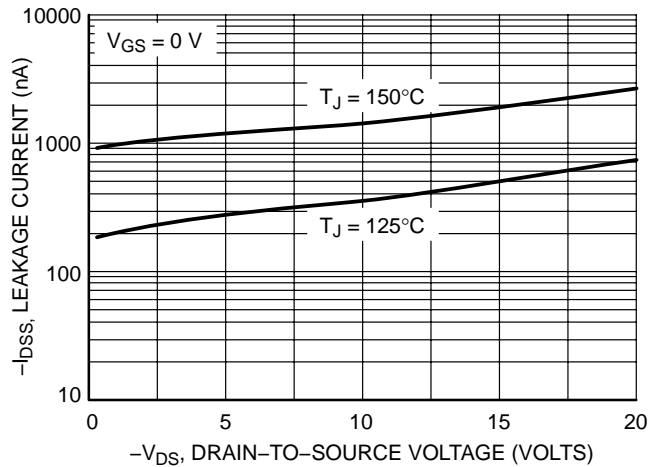


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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

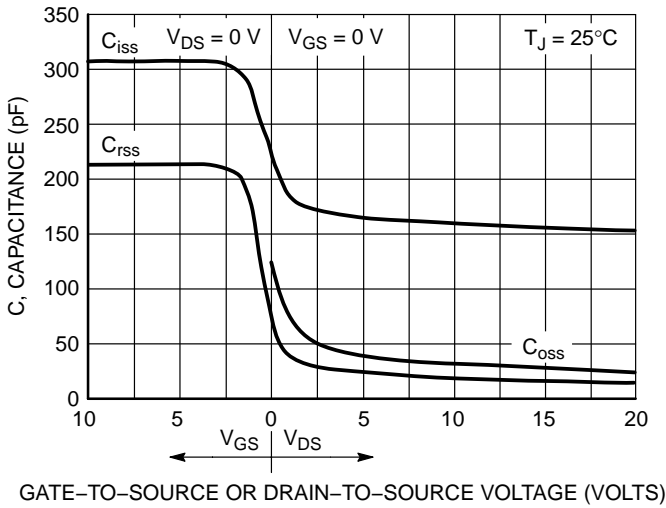


Figure 7. Capacitance Variation

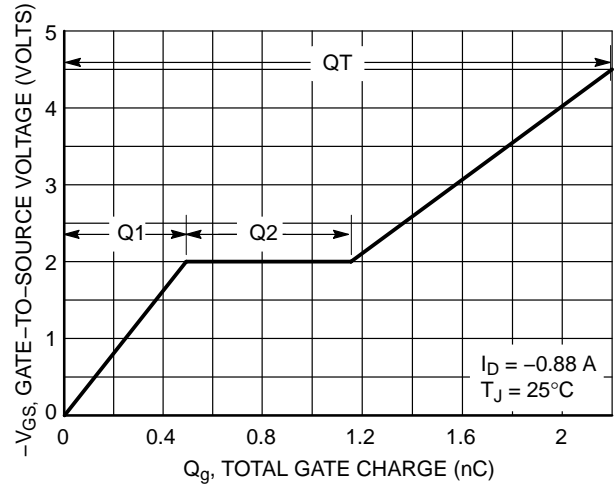


Figure 8. Gate-to-Source Voltage vs. Total Gate Charge

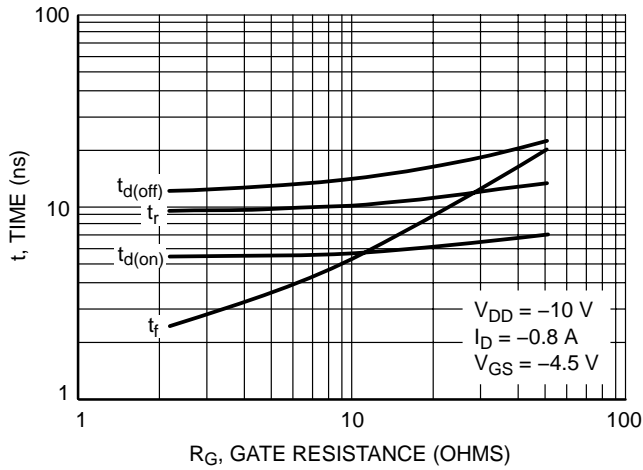


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

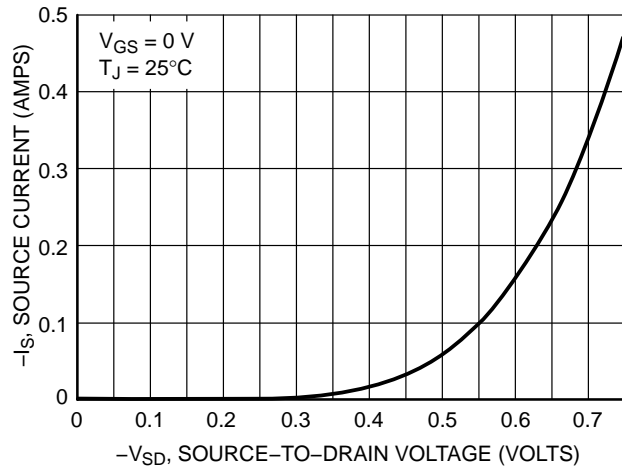


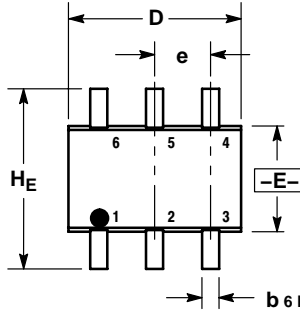
Figure 10. Diode Forward Voltage vs. Current

# NTJD4158C

## PACKAGE DIMENSIONS

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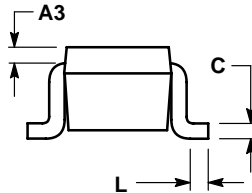
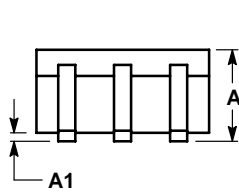
SC-88 (SOT-363)  
CASE 419B-02  
ISSUE V



$\oplus$	0.2 (0.008)	$\textcircled{M}$	$\textcircled{E}$	$\textcircled{M}$
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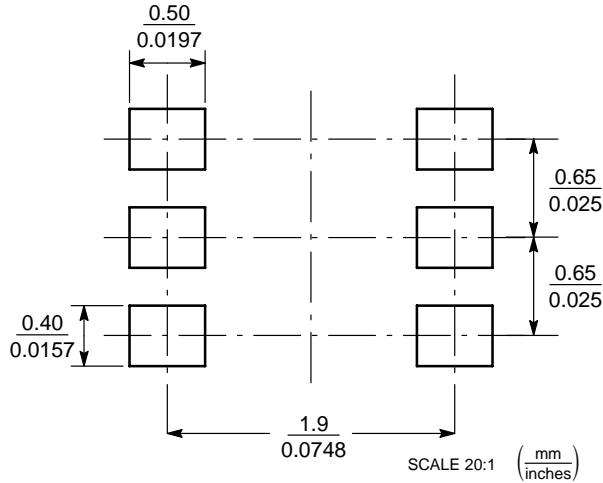
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. 419B-01 OBSOLETE, NEW STANDARD 419B-02.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.80	0.95	1.10	0.031	0.037	0.043
A1	0.00	0.05	0.10	0.000	0.002	0.004
A3	0.20 REF			0.008 REF		
b	0.10	0.21	0.30	0.004	0.008	0.012
C	0.10	0.14	0.25	0.004	0.005	0.010
D	1.80	2.00	2.20	0.070	0.078	0.086
E	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65 BSC			0.026 BSC		
L	0.10	0.20	0.30	0.004	0.008	0.012
HE	2.00	2.10	2.20	0.078	0.082	0.086




- STYLE 26:  
PIN 1. SOURCE 1  
2. GATE 1  
3. DRAIN 2  
4. SOURCE 2  
5. GATE 2  
6. DRAIN 1

### 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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