

# NTJS3157N

## Trench Power MOSFET

20 V, 4.0 A, Single N-Channel, SC-88

### Features

- Leading Trench Technology for Low  $R_{DS(ON)}$  Extending Battery Life
- Fast Switching for Increased Circuit Efficiency
- SC-88 Small Outline (2 x 2 mm) for Maximum Circuit Board Utilization, Same as SC-70-6
- These are Pb-Free Devices

### Applications

- DC-DC Conversion
- Low Side Load Switch
- Cell Phones, Computing, Digital Cameras, MP3s and PDAs

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

Parameter		Symbol	Value	Unit	
Drain-to-Source Voltage		$V_{DS}$	20	V	
Gate-to-Source Voltage		$V_{GS}$	$\pm 8.0$	V	
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	3.2	A	
		$T_A = 85^\circ\text{C}$	2.3		
	$t \leq 5\text{ s}$	$T_A = 25^\circ\text{C}$	4.0		
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	1.0	W
Pulsed Drain Current		$t_p = 10\ \mu\text{s}$	$I_{DM}$	10	A
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$	
Source Current (Body Diode)		$I_S$	1.6	A	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$	

### THERMAL RESISTANCE RATINGS (Note 1)

Parameter	Symbol	Max	Unit
Junction-to-Ambient – Steady State	$R_{\theta JA}$	125	$^\circ\text{C}/\text{W}$
Junction-to-Ambient – $t \leq 5\text{ s}$	$R_{\theta JA}$	80	
Junction-to-Lead – Steady State	$R_{\theta JL}$	45	

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 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).

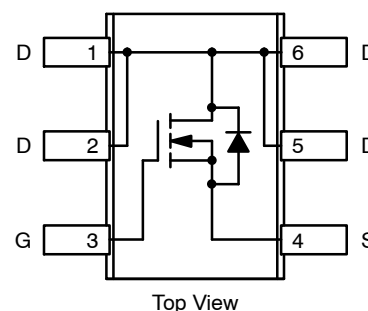


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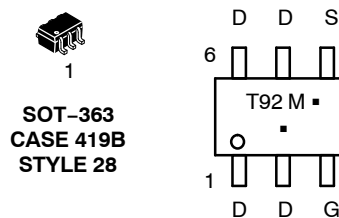
<http://onsemi.com>

$V_{(BR)DSS}$	$R_{DS(on)}$ Typ	$I_D$ Max
20 V	45 m $\Omega$ @ 4.5 V	4.0 A
	55 m $\Omega$ @ 2.5 V	
	70 m $\Omega$ @ 1.8 V	

### SC-88 (SOT-363)



### MARKING DIAGRAM & PIN ASSIGNMENT



T92 = Device Code  
M = Date Code  
■ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

# NTJS3157N

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	20			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$		12		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 16\text{ V}$	$T_J = 25^\circ\text{C}$		1.0	$\mu\text{A}$
			$T_J = 85^\circ\text{C}$		5.0	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8.0\text{ V}$			$\pm 100$	nA

### ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	0.40		1.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$		$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$		-4.0	
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 4.0\text{ A}$		45	60	mΩ
			$V_{GS} = 2.5\text{ V}, I_D = 3.6\text{ A}$	55	70	
			$V_{GS} = 1.8\text{ V}, I_D = 2.0\text{ A}$	70	85	
Forward Transconductance	$g_{FS}$	$V_{GS} = 10\text{ V}, I_D = 3.2\text{ A}$		9.0		S

### CHARGES AND CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 10\text{ V}$		500		pF	
Output Capacitance	$C_{OSS}$		$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 10\text{ V}$		75		
Reverse Transfer Capacitance	$C_{RSS}$				60		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 10\text{ V}, I_D = 3.2\text{ A}$		6.9	15	nC	
Gate-to-Source Charge	$Q_{GS}$			1.0			
Gate-to-Drain Charge	$Q_{GD}$			1.8			

### SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 4.5\text{ V}, V_{DD} = 10\text{ V}, I_D = 0.5\text{ A}, R_G = 6.0\ \Omega$		6.0	15	ns
Rise Time	$t_r$			12	25	
Turn-Off Delay Time	$t_{d(off)}$			21	45	
Fall Time	$t_f$			11	25	

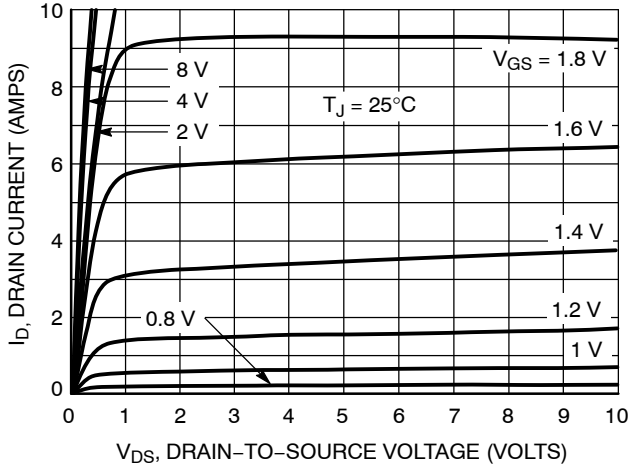
### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 1.6\text{ A}$	$T_J = 25^\circ\text{C}$		0.7	1.0	V
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s}, I_S = 1.6\text{ A}$			15		ns
Charge Time	$T_a$				12		
Discharge Time	$T_b$				3.0		
Reverse Recovery Charge	$Q_{RR}$				5.0		

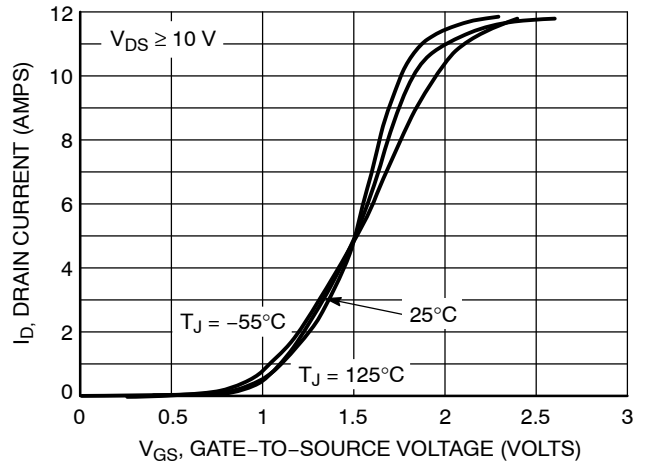
2. Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .
3. Switching characteristics are independent of operating junction temperatures.

# NTJS3157N

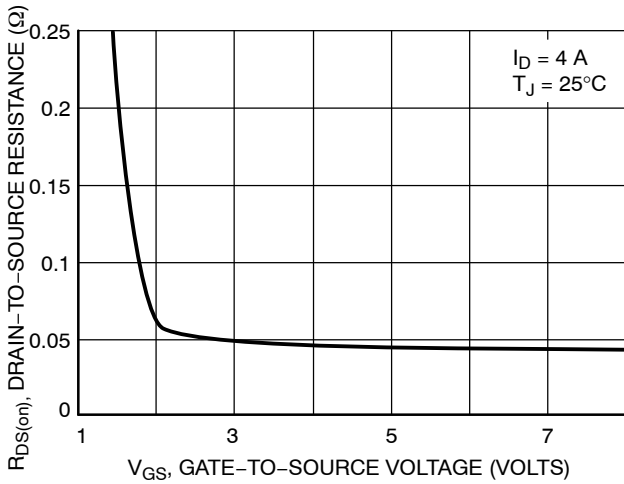
## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)



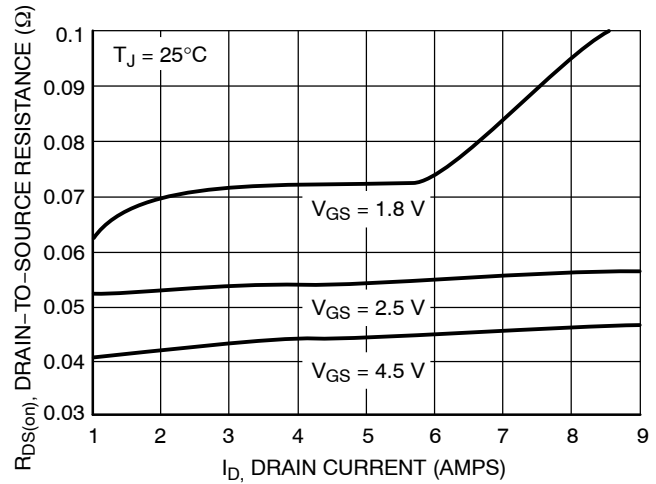
**Figure 1. On-Region Characteristics**



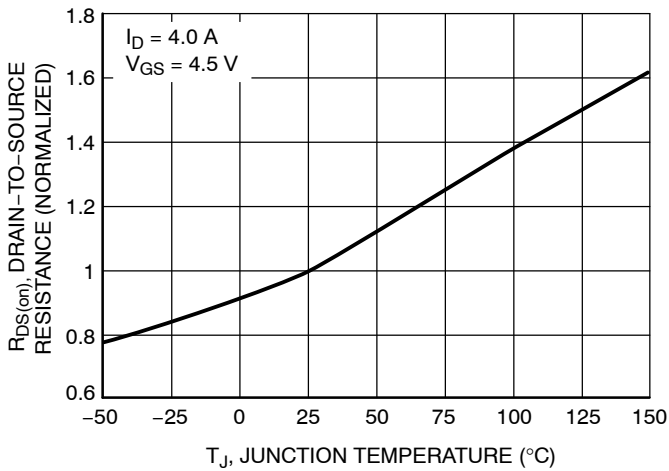
**Figure 2. Transfer Characteristics**



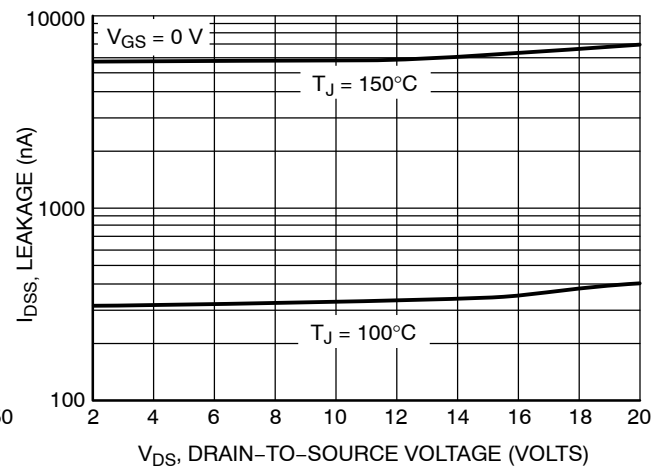
**Figure 3. On-Resistance vs. Gate-to-Source Voltage**



**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**

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

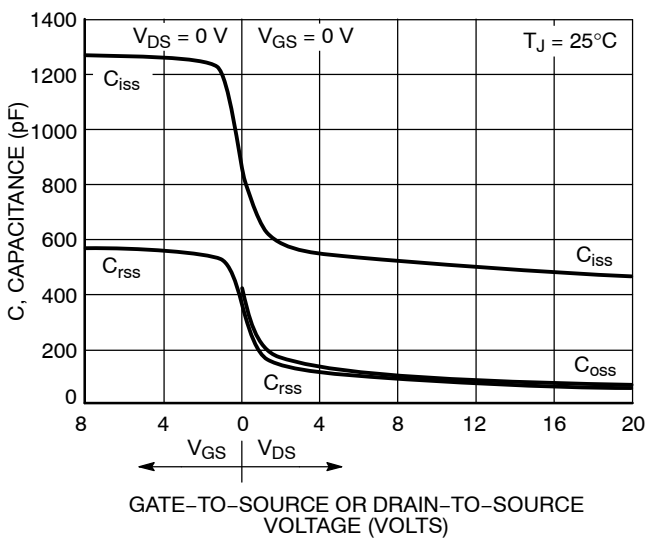


Figure 7. Capacitance Variation

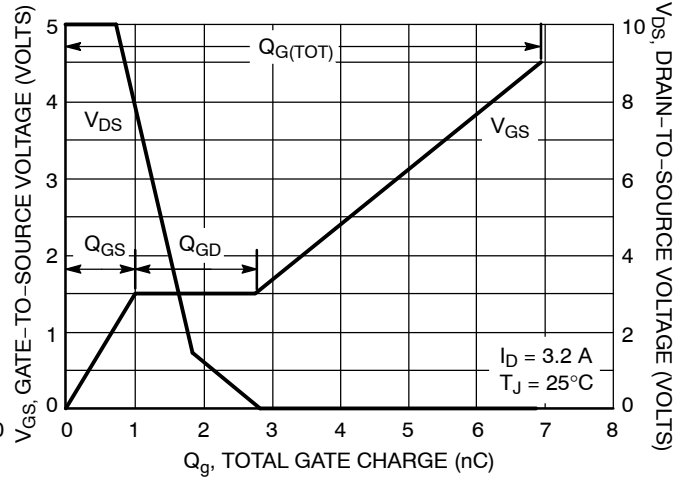


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

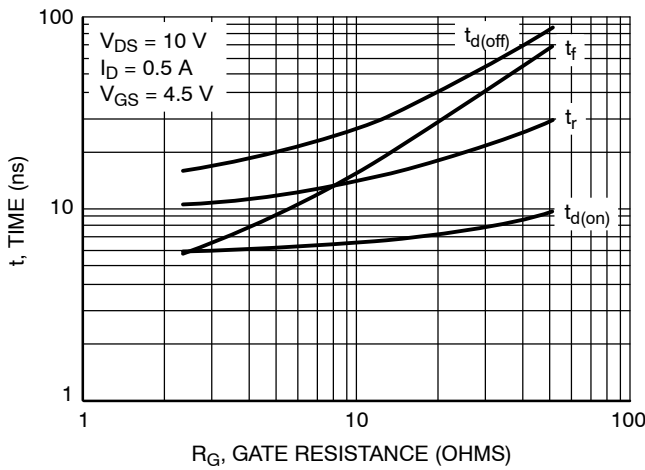


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

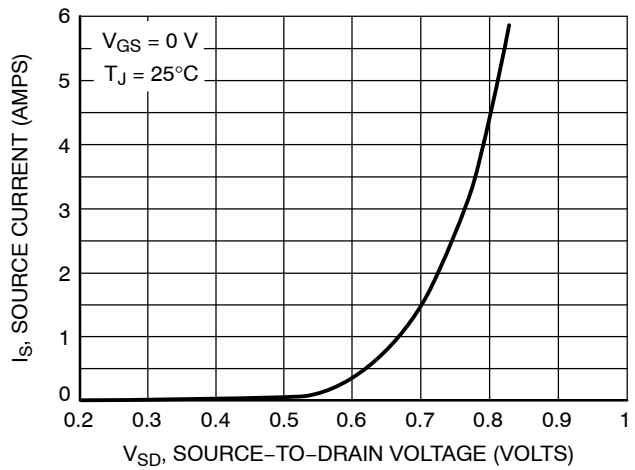


Figure 10. Diode Forward Voltage vs. Current

# NTJS3157N

## ORDERING INFORMATION

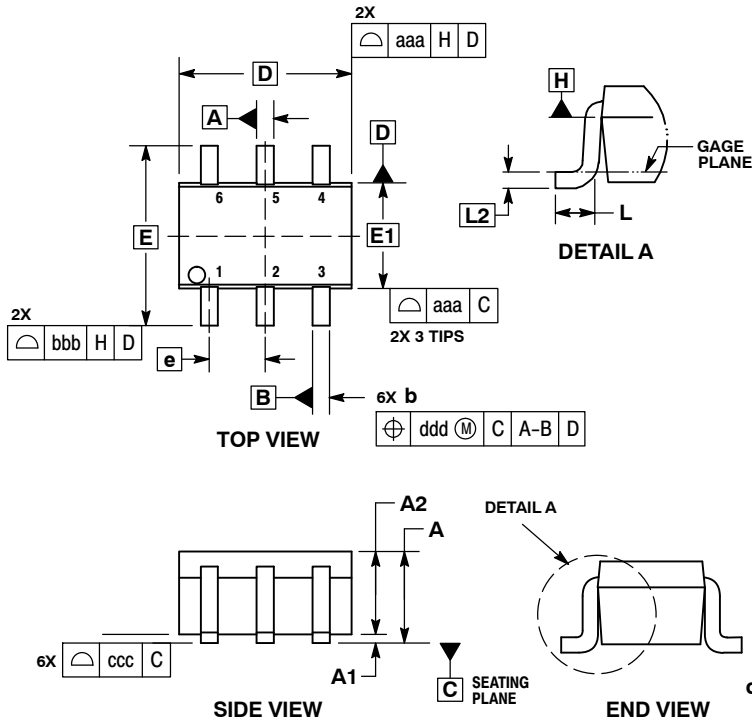
Device	Package	Shipping†
NTJS3157NT1G	SC-88 (Pb-Free)	3000 Tape & Reel
NTJS3157NT2G	SC-88 (Pb-Free)	3000 Tape & Reel

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

# NTJS3157N

## PACKAGE DIMENSIONS

SC-88/SC70-6/SOT-363  
CASE 419B-02  
ISSUE Y

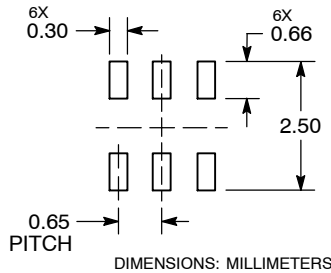


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
5. DATUMS A AND B ARE DETERMINED AT DATUM H.
6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	---	---	1.10	---	---	0.043
A1	0.00	---	0.10	0.000	---	0.004
A2	0.70	0.90	1.00	0.027	0.035	0.039
b	0.15	0.20	0.25	0.006	0.008	0.010
C	0.08	0.15	0.22	0.003	0.006	0.009
D	1.80	2.00	2.20	0.070	0.078	0.086
E	2.00	2.10	2.20	0.078	0.082	0.086
E1	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65 BSC			0.026 BSC		
L	0.26	0.36	0.46	0.010	0.014	0.018
L2	0.15 BSC			0.006 BSC		
aaa	0.15			0.006		
bbb	0.30			0.012		
ccc	0.10			0.004		
ddd	0.10			0.004		

**RECOMMENDED SOLDERING FOOTPRINT\***



**STYLE 28:**

- PIN 1. DRAIN
- DRAIN
- GATE
- SOURCE
- DRAIN
- DRAIN

\*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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