

# NTJD4401N

## Small Signal MOSFET 20 V, Dual N-Channel, SC-88 ESD Protection

### Features

- Small Footprint (2 x 2 mm)
- Low Gate Charge N-Channel Device
- ESD Protected Gate
- Same Package as SC-70 (6 Leads)
- Pb-Free Packages are Available

### Applications

- Load Power switching
- Li-Ion Battery Supplied Devices
- Cell Phones, Media Players, Digital Cameras, PDAs
- DC-DC Conversion

### MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise stated)

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		V <sub>DSS</sub>	20	V
Gate-to-Source Voltage		V <sub>GS</sub>	±12	V
Continuous Drain Current (Based on R <sub>θJA</sub> )	Steady State	I <sub>D</sub>	T <sub>A</sub> = 25°C	0.63
			T <sub>A</sub> = 85°C	0.46
Power Dissipation (Based on R <sub>θJA</sub> )	Steady State	P <sub>D</sub>	T <sub>A</sub> = 25°C	0.27
			T <sub>A</sub> = 85°C	0.14
Continuous Drain Current (Based on R <sub>θJL</sub> )	Steady State	I <sub>D</sub>	T <sub>A</sub> = 25°C	0.91
			T <sub>A</sub> = 85°C	0.65
Power Dissipation (Based on R <sub>θJL</sub> )	Steady State	P <sub>D</sub>	T <sub>A</sub> = 25°C	0.55
			T <sub>A</sub> = 85°C	0.29
Pulsed Drain Current		t ≤ 10 μs	I <sub>DM</sub>	±1.2
Operating Junction and Storage Temperature		T <sub>J</sub> , T <sub>STG</sub>	-55 to 150	°C
Continuous Source Current (Body Diode)		I <sub>S</sub>	0.63	A
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		T <sub>L</sub>	260	°C

### THERMAL RESISTANCE RATINGS (Note 1)

Parameter	Symbol	Typ	Max	Units
Junction-to-Ambient – Steady State	R <sub>θJA</sub>	400	460	°C/W
Junction-to-Lead (Drain) – Steady State	R <sub>θJL</sub>	194	226	

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 oz Cu area = 0.9523 in sq.

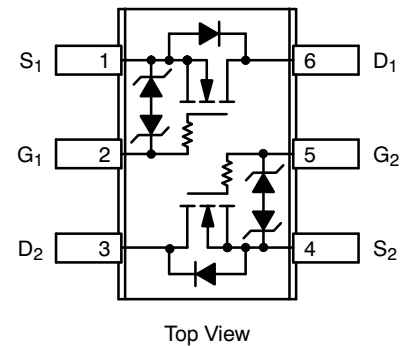


ON Semiconductor®

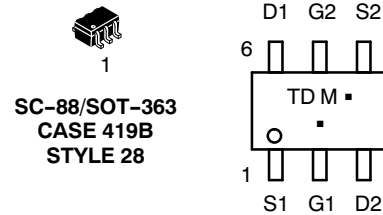
<http://onsemi.com>

V <sub>(BR)DSS</sub>	R <sub>DS(on)</sub> Typ	I <sub>D</sub> Max
20 V	0.22 Ω @ 4.5 V	0.775 A
	0.32 Ω @ 2.5 V	
	0.51 Ω @ 1.8 V	

### SC-88 (SOT-363)



### MARKING DIAGRAM & PIN ASSIGNMENT



TD = 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 4 of this data sheet.

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

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

Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	20	27		V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>			22		mV/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 16 V			1.0	μA
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±12 V			10	μA

### ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	0.6	0.92	1.5	V
Gate Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>			-2.1		mV/°C
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 0.63 A		0.29	0.375	Ω
		V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 0.40 A		0.36	0.445	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 4.0 V, I <sub>D</sub> = 0.63 A		2.0		S

### CHARGES AND CAPACITANCES

Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = 20 V		33	46	pF
Output Capacitance	C <sub>OSS</sub>			13	22	
Reverse Transfer Capacitance	C <sub>RSS</sub>			2.8	5.0	
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.63 A		1.3	3.0	nC
Threshold Gate Charge	Q <sub>G(TH)</sub>			0.1		
Gate-to-Source Charge	Q <sub>GS</sub>			0.2		
Gate-to-Drain Charge	Q <sub>GD</sub>			0.4		

### SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	t <sub>d(ON)</sub>	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		0.083		μs
Rise Time	t <sub>r</sub>			0.227		
Turn-Off Delay Time	t <sub>d(OFF)</sub>			0.786		
Fall Time	t <sub>f</sub>			0.506		

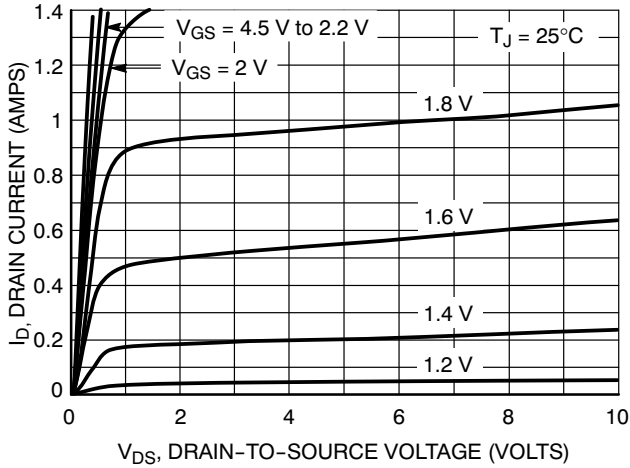
### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 0.23 A	T <sub>J</sub> = 25°C	0.76	1.1	V
			T <sub>J</sub> = 125°C	0.63		
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs, I <sub>S</sub> = 0.63 A		0.410		μs

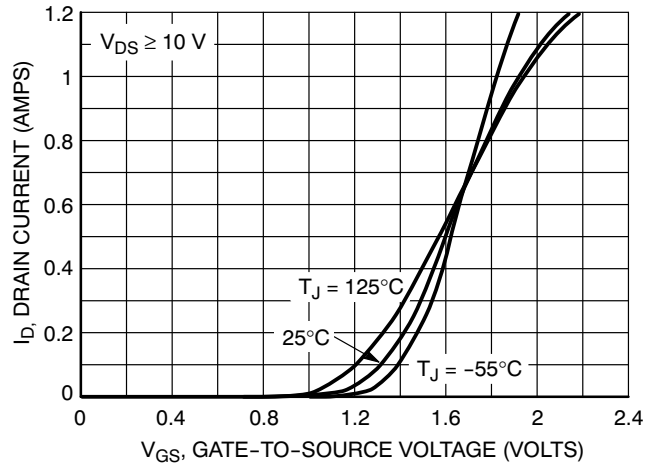
- Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
- Switching characteristics are independent of operating junction temperatures.

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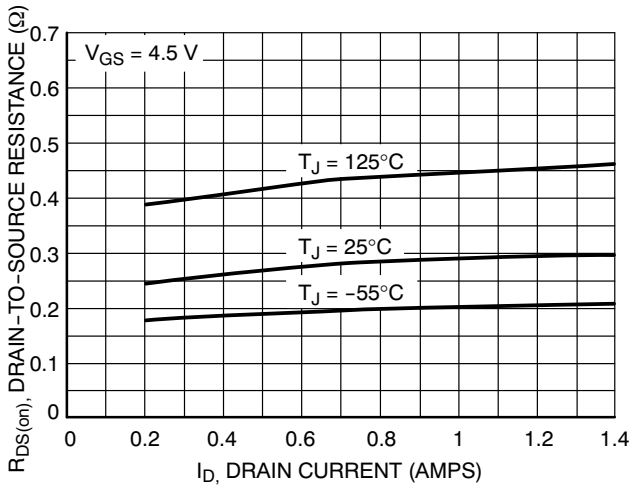
## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)



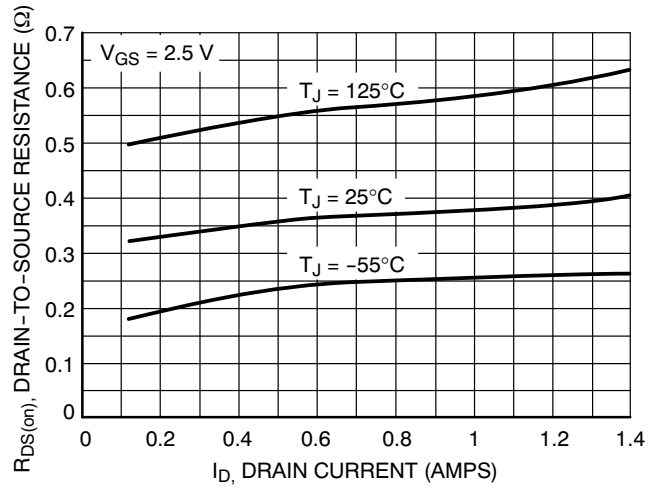
**Figure 1. On-Region Characteristics**



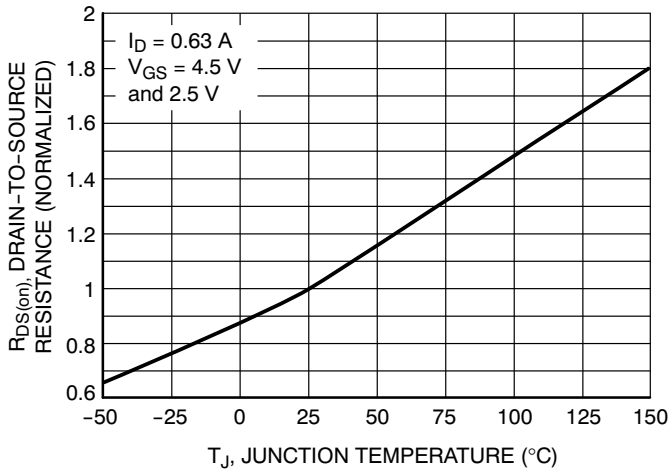
**Figure 2. Transfer Characteristics**



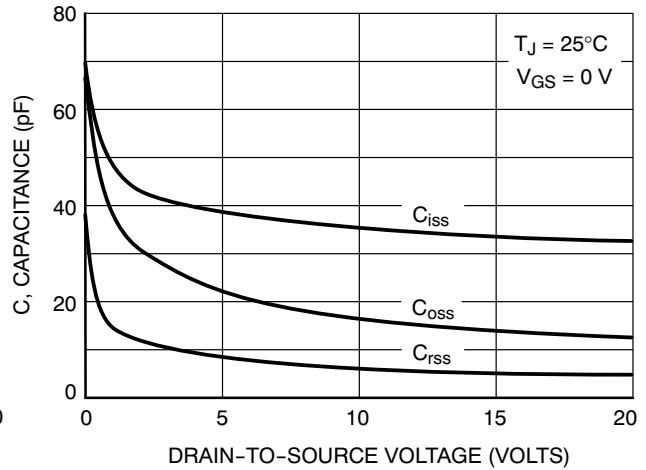
**Figure 3. On-Resistance vs. Drain Current and Temperature**



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



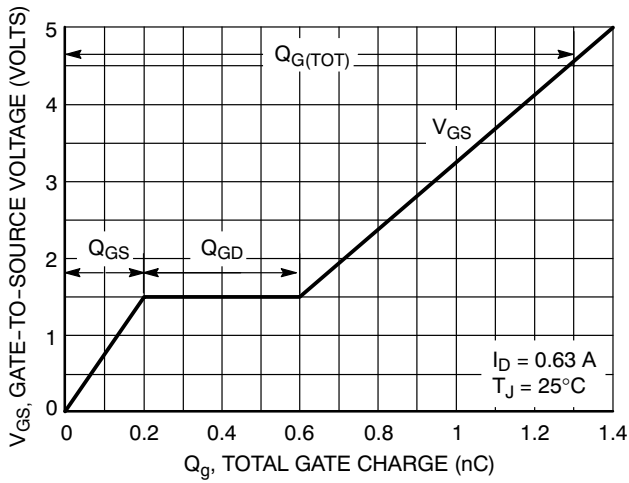
**Figure 5. On-Resistance Variation with Temperature**



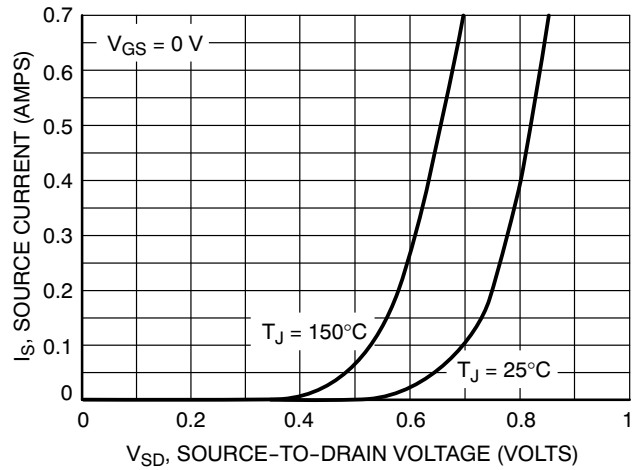
**Figure 6. Capacitance Variation**

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



**Figure 7. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



**Figure 8. Diode Forward Voltage vs. Current**

### ORDERING INFORMATION

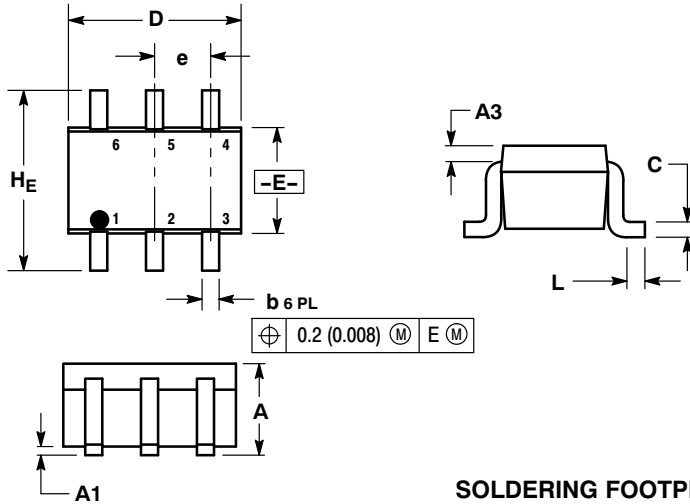
Device	Package	Shipping <sup>†</sup>
NTJD4401NT1	SC-88	3000 / Tape & Reel
NTJD4401NT1G	SC-88 (Pb-Free)	3000 / Tape & Reel
NTJD4401NT2	SC-88	3000 / Tape & Reel
NTJD4401NT2G	SC-88 (Pb-Free)	3000 / Tape & Reel
NTJD4401NT4	SC-88	10,000 / Tape & Reel
NTJD4401NT4G	SC-88 (Pb-Free)	10,000 / Tape & Reel

<sup>†</sup>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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## PACKAGE DIMENSIONS

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



### NOTES:

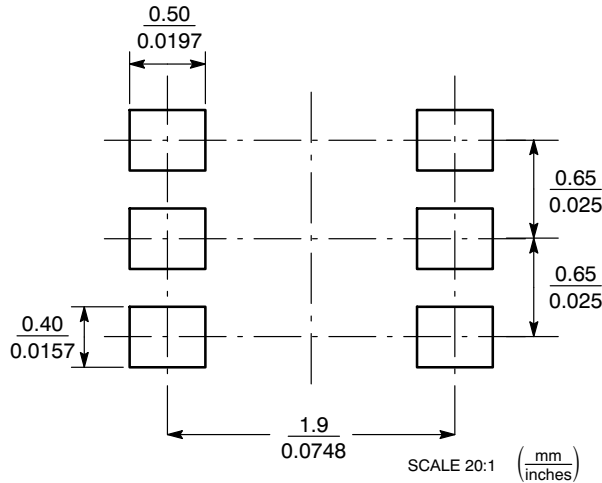
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419B-01 OBSOLETE, NEW STANDARD 419B-02.

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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