

# NTS4001N

## Small Signal MOSFET

30 V, 270 mA, Single N-Channel, SC-70



ON Semiconductor®

<http://onsemi.com>

### Features

- Low Gate Charge for Fast Switching
- Small Footprint – 30% Smaller than TSOP-6
- ESD Protected Gate
- Pb-Free Package is Available

### Applications

- Low Side Load Switch
- Li-Ion Battery Supplied Devices – Cell Phones, PDAs, DSC
- Buck Converters
- Level Shifts

| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP     | $I_D$ Max |
|---------------|----------------------|-----------|
| 30 V          | 1.0 $\Omega$ @ 4.0 V | 270 mA    |
|               | 1.5 $\Omega$ @ 2.5 V |           |

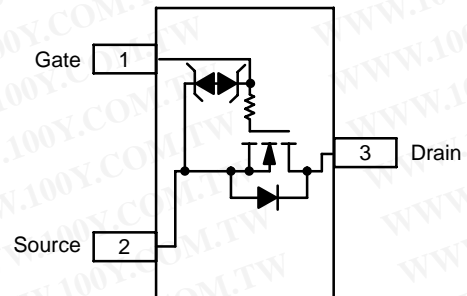
### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

| Parameter   |              |                                    | Symbol         | Value      | Units              |
|---|--------------|------------------------------------|----------------|------------|--------------------|
| Drain-to-Source Voltage   |              |                                    | $V_{DSS}$      | 30         | V                  |
| Gate-to-Source Voltage  |              |                                    | $V_{GS}$       | $\pm 20$   | V                  |
| Continuous Drain Current (Note 1)                                 | Steady State | $T_A = 25\text{ }^{\circ}\text{C}$ | $I_D$          | 270        | mA                 |
|   |              | $T_A = 85\text{ }^{\circ}\text{C}$ |                | 200        |                    |
| Power Dissipation (Note 1)  | Steady State | $T_A = 25\text{ }^{\circ}\text{C}$ | $P_D$          | 330        | mW                 |
| Pulsed Drain Current  |              | $t = 10\text{ }\mu\text{s}$        | $I_{DM}$       | 800        | mA                 |
| Operating Junction and Storage Temperature                        |              |                                    | $T_J, T_{STG}$ | -55 to 150 | $^{\circ}\text{C}$ |
| Source Current (Body Diode)                                       |              |                                    | $I_S$          | 270        | 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.

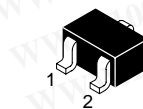
1. Surface mounted on FR4 board using 1 in sq. pad size (Cu area = 1.127 in sq. [1 oz] including traces).

### SC-70/SOT-323 (3 LEADS)

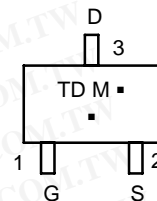


(Top View)

### MARKING DIAGRAM & PIN ASSIGNMENT



SC-70 / SOT-323  
 CASE 419  
 STYLE 8



TD = Device Code  
 M = Date Code\*  
 ■ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

### ORDERING INFORMATION

| Device      | Package         | Shipping†        |
|-------------|-----------------|------------------|
| NTS4001NT1  | SC-70           | 3000/Tape & Reel |
| NTS4001NT1G | SC-70 (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.

# NTS4001N

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

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|-----------|--------|----------------|-----|-----|-----|------|
|-----------|--------|----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|   |                   |   |    |    |           |               |
|---|-------------------|---|----|----|-----------|---------------|
| Drain-to-Source Breakdown Voltage                         | $V_{(BR)DSS}$     | $V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$ | 30 |    |           | V             |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ |   |    | 60 |           | mV/°C         |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | $V_{GS} = 0\text{ V}, V_{DS} = 30\text{ V}$         |    |    | 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 2)

|  |                  |   |     |      |     |          |
|--|------------------|---|-----|------|-----|----------|
| Gate Threshold Voltage                 | $V_{GS(TH)}$     | $V_{GS} = V_{DS}, I_D = 100\text{ }\mu\text{A}$ | 0.8 | 1.2  | 1.5 | V        |
| Gate Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ |   |     | -3.4 |     | mV/°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               | $g_{FS}$         | $V_{DS} = 3.0\text{ V}, I_D = 10\text{ mA}$     |     | 80   |     | mS       |

### CHARGES AND CAPACITANCES

|                              |              |   |  |      |     |    |
|------------------------------|--------------|---|--|------|-----|----|
| Input Capacitance            | $C_{ISS}$    | $V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 5.0\text{ V}$  |  | 20   | 33  | pF |
| Output Capacitance           | $C_{OSS}$    |   |  | 19   | 32  |    |
| Reverse Transfer Capacitance | $C_{RSS}$    |   |  | 7.25 | 12  |    |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 5.0\text{ V}, V_{DS} = 24\text{ V}, I_D = 0.1\text{ A}$ |  | 0.9  | 1.3 | nC |
| Threshold Gate Charge        | $Q_{G(TH)}$  |   |  | 0.2  |     |    |
| Gate-to-Source Charge        | $Q_{GS}$     |   |  | 0.3  |     |    |
| Gate-to-Drain Charge         | $Q_{GD}$     |   |  | 0.2  |     |    |

### SWITCHING CHARACTERISTICS (Note 3)

|                     |              |  |  |    |  |    |
|---------------------|--------------|--|--|----|--|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = 4.5\text{ V}, V_{DD} = 5.0\text{ V}, I_D = 10\text{ mA}, R_G = 50\text{ }\Omega$ |  | 17 |  | ns |
| Rise Time           | $t_r$        |  |  | 23 |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |  |  | 94 |  |    |
| Fall Time           | $t_f$        |  |  | 82 |  |    |

### DRAIN-SOURCE 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  |
|                       |          |   | $T_J = 125^\circ\text{C}$ |  | 0.43 |     |    |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS} = 0\text{ V}, dI_S/dt = 8.0\text{ A}/\mu\text{s}, I_S = 10\text{ mA}$ |                           |  | 5.0  |     | ns |

2. Pulse Test: pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

3. Switching characteristics are independent of operating junction temperatures.

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# NTS4001N

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

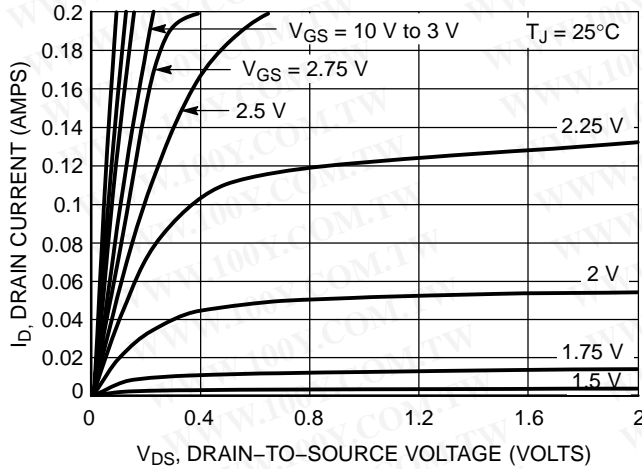


Figure 1. On-Region Characteristics

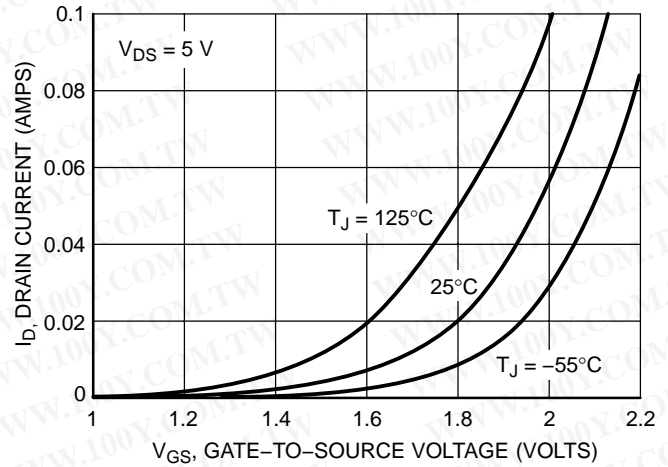


Figure 2. Transfer Characteristics

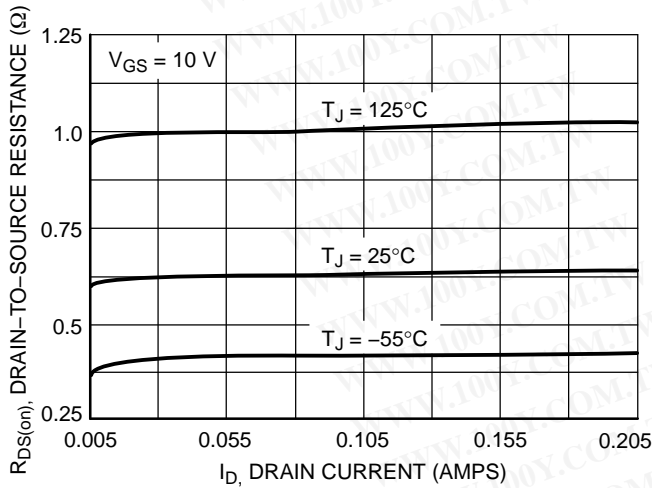


Figure 3. On-Resistance vs. Drain Current and Temperature

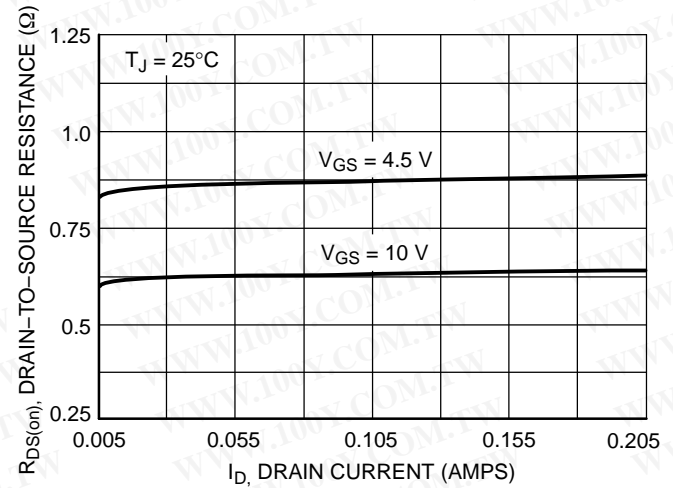


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

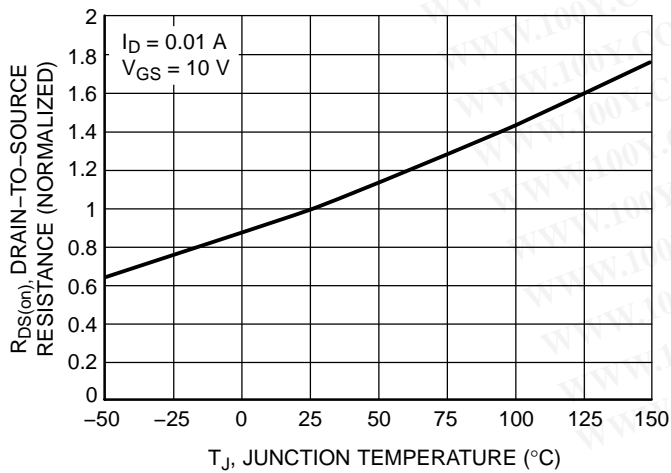


Figure 5. On-Resistance Variation with Temperature

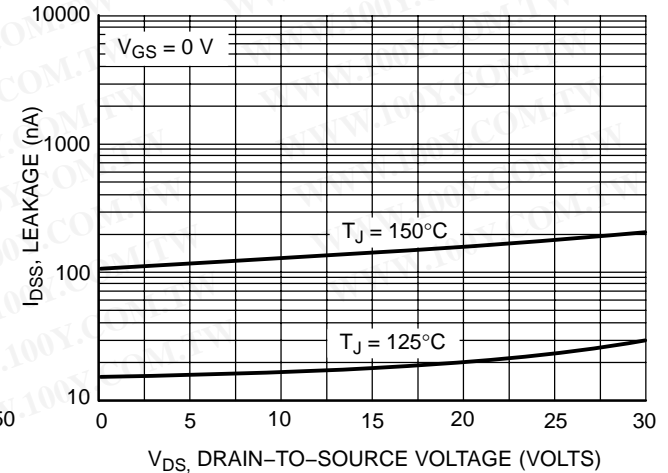
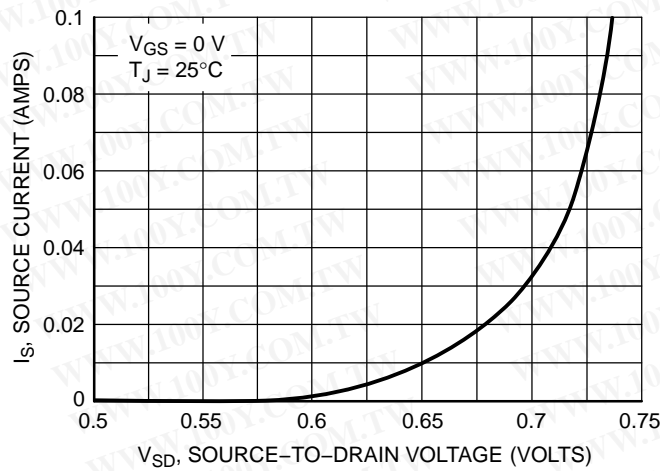
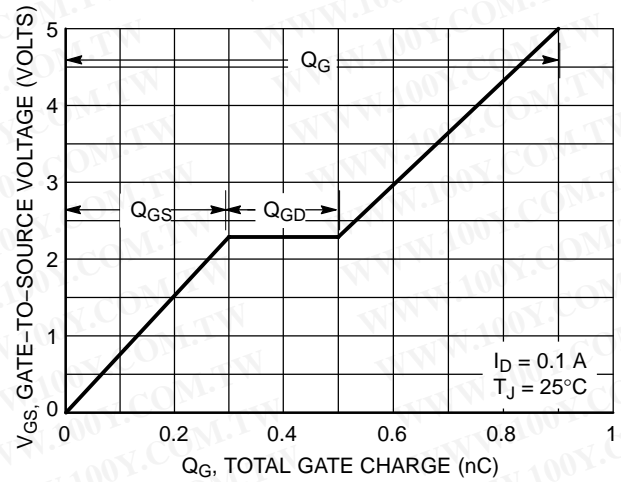
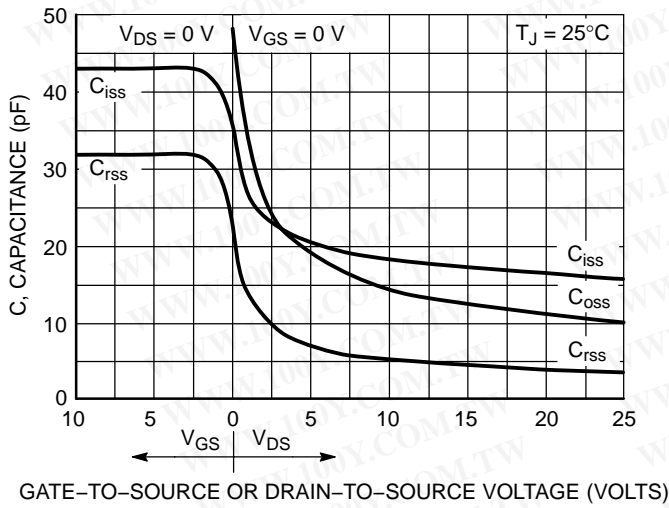


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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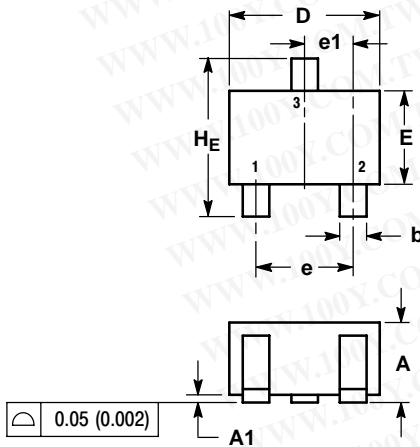
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## PACKAGE DIMENSIONS

SC-70 (SOT-323)  
CASE 419-04  
ISSUE M

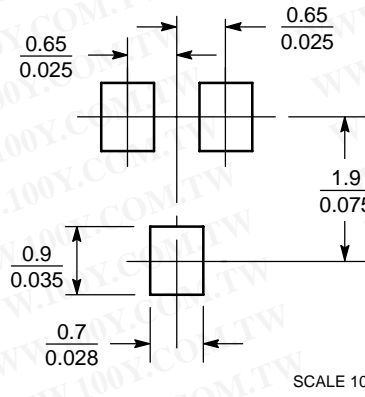


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

| DIM | MILLIMETERS |      |      | INCHES    |       |       |
|-----|-------------|------|------|-----------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN       | NOM   | MAX   |
| A   | 0.80        | 0.90 | 1.00 | 0.032     | 0.035 | 0.040 |
| A1  | 0.00        | 0.05 | 0.10 | 0.000     | 0.002 | 0.004 |
| A2  | 0.7 REF     |      |      | 0.028 REF |       |       |
| b   | 0.30        | 0.35 | 0.40 | 0.012     | 0.014 | 0.016 |
| c   | 0.10        | 0.18 | 0.25 | 0.004     | 0.007 | 0.010 |
| D   | 1.80        | 2.10 | 2.20 | 0.071     | 0.083 | 0.087 |
| E   | 1.15        | 1.24 | 1.35 | 0.045     | 0.049 | 0.053 |
| e   | 1.20        | 1.30 | 1.40 | 0.047     | 0.051 | 0.055 |
| e1  | 0.65 BSC    |      |      | 0.026 BSC |       |       |
| L   | 0.425 REF   |      |      | 0.017 REF |       |       |
| He  | 2.00        | 2.10 | 2.40 | 0.079     | 0.083 | 0.095 |

- STYLE 8:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN


### SOLDERING FOOTPRINT\*



SCALE 10:1 (mm/inches)

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

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