# NTS4101P

# Power MOSFET

## −20 V, −1.37 A, Single P−Channel, SC−70

### Features

- Leading −20 V Trench for Low $R_{DS(on)}$
- −2.5 V Rated for Low Voltage Gate Drive
- SC−70 Surface Mount for Small Footprint (2x2 mm)
- Pb−Free Package is Available

### Applications

- High Side Load Switch
- Charging Circuit
- Single Cell Battery Applications such as; Cell Phones, Digital Cameras, PDAs

**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise stated)

| Parameter | | | Symbol | Value | Units |
|---|---|---|---|---|---|
| Drain−to−Source Voltage | | | $V_{DSS}$ | −20 | V |
| Gate−to−Source Voltage | | | $V_{GS}$ | ±12 | V |
| Continuous Drain Current (Note 1) | Steady State | $T_A$ = 25°C | $I_D$ | −1.28 | A |
| | | $T_A$ = 70°C | | −1.00 | |
| | t ≤ 5 s | $T_A$ = 25°C | | −1.37 | A |
| Power Dissipation (Note 1) | Steady State | $T_A$ = 25°C | $P_D$ | 0.29 | W |
| | t ≤ 5 s | | | 0.33 | W |
| Pulsed Drain Current | $t_p$ = 10 μs | | $I_{DM}$ | −4.0 | A |
| Operating Junction and Storage Temperature | | | $T_J$, $T_{STG}$ | −55 to 150 | °C |
| Source Current (Body Diode), Continuous | | | $I_S$ | −0.5 | A |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | | | $T_L$ | 260 | °C |

**THERMAL RESISTANCE RATINGS**

| Parameter | Symbol | Max | Units |
|---|---|---|---|
| Junction−to−Ambient – Steady State (Note 1) | $R_{\theta JA}$ | 430 | °C/W |
| Junction−to−Ambient − t ≤ 5 s (Note 1) | $R_{\theta JA}$ | 375 | |

1. Surface−mounted on FR4 board using 1″ 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 (Cu area = TBD in sq).

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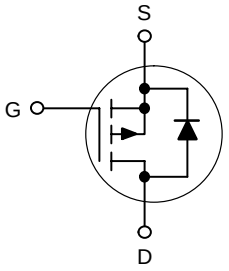
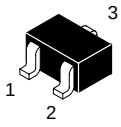
| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP | $I_D$ Max |
|---|---|---|
| −20 V | 83 mΩ @ −4.5 V | −1.37 A |
| | 88 mΩ @ −3.6 V | |
| | 104 mΩ @ −2.5 V | |

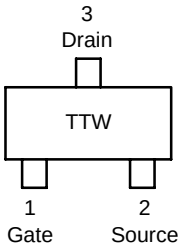
**P−Channel MOSFET**




**MARKING DIAGRAM & PIN ASSIGNMENT**




**SC−70/SOT−323**
**CASE 419**
**STYLE 8**




TT = Device Code
W = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping† |
|---|---|---|
| NTS4101PT1 | SOT−323 | 3000/Tape & Reel |
| NTS4101PT1G | SOT−323 (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.

**ELECTRICAL CHARACTERISTICS** ($T_J$=25°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 V, $I_D$ = −250 μA | | −20 | −24.5 | | V |
| Drain−to−Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | | −13.7 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = −20 V | $T_J$ = 25°C | | | −1.0 | μA |
| | | | $T_J$ = 70°C | | | −5.0 | |
| Gate−to−Source Leakage Current | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±12 V | | | | ±100 | nA |
| **ON CHARACTERISTICS** (Note 3) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = −250 μA | | −0.45 | −0.64 | | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | | 2.7 | | mV/°C |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = −4.5 V, $I_D$ = −1.0 A | | | 83 | 120 | mΩ |
| | | $V_{GS}$ = −3.6 V, $I_D$ = −0.7 A | | | 88 | 130 | |
| | | $V_{GS}$ = −2.5 V, $I_D$ = −0.3 A | | | 104 | 160 | |
| **CHARGES AND CAPACITANCES** | | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 1.0 MHz, $V_{DS}$ = −20 V | | | 603 | | pF |
| Output Capacitance | $C_{OSS}$ | | | | 90 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | | 62 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = −4.5 V, $V_{DS}$ = −4.5 V, $I_D$ = −1.0 A | | | 6.4 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | | 0.7 | | |
| Gate−to−Source Charge | $Q_{GS}$ | | | | 1.0 | | |
| Gate−to−Drain Charge | $Q_{GD}$ | | | | 1.5 | | |
| **SWITCHING CHARACTERISTICS** (Note 4) | | | | | | | |
| Turn−On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = −4.5 V, $V_{DD}$ = −4.0 V, $I_D$ = −1.0 A, $R_G$ = 6.2 Ω | | | 6.2 | | ns |
| Rise Time | $t_r$ | | | | 14.9 | | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | | | 26 | | |
| Fall Time | $t_f$ | | | | 18 | | |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = −0.3 A | $T_J$ = 25°C | | −0.61 | −1.2 | V |
| | | | $T_J$ = 125°C | | −0.5 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, $dI_{SD}/dt$ = 100 A/μs, $I_S$ = −1.0 A | | | 10.9 | | ns |
| Charge Time | $T_a$ | | | | 7.1 | | |
| Discharge Time | $T_b$ | | | | 3.8 | | |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 4.25 | | nC |

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

## TYPICAL CHARACTERISTICS

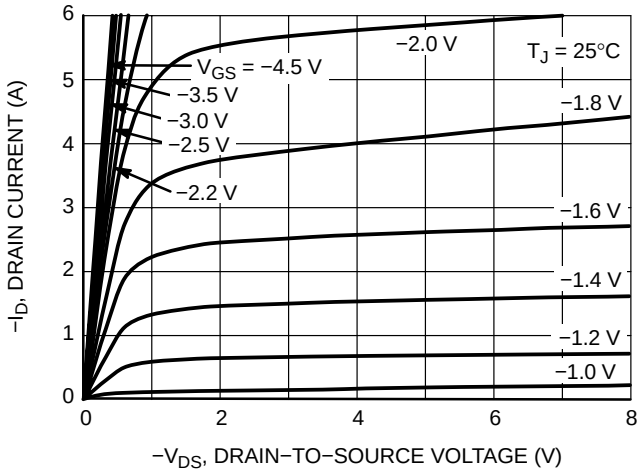



**Figure 1. On−Region Characteristics**

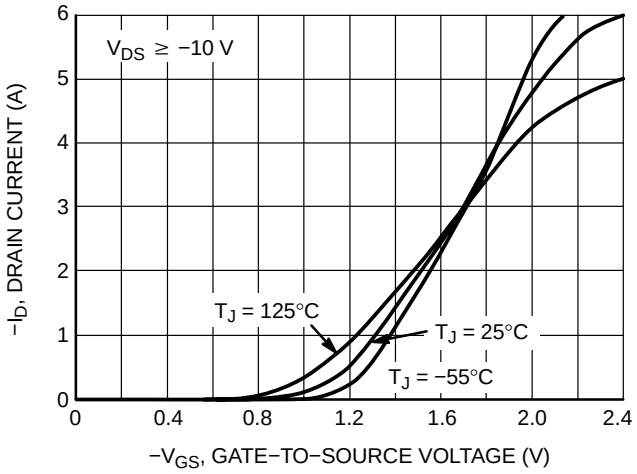



**Figure 2. Transfer Characteristics**

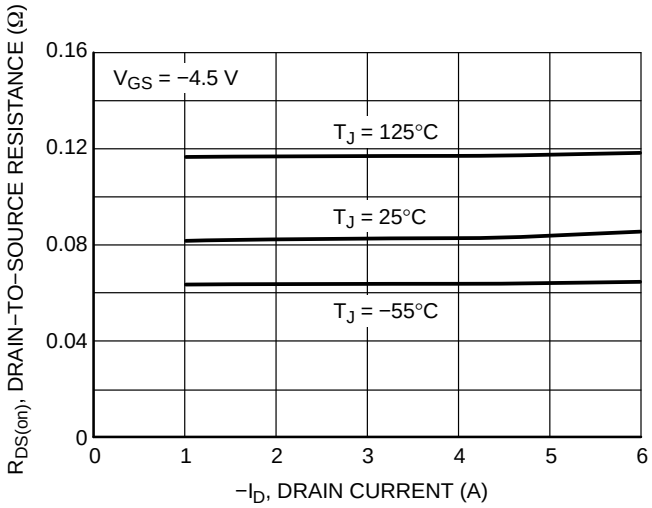



**Figure 3. On−Resistance versus Drain Current and Temperature**

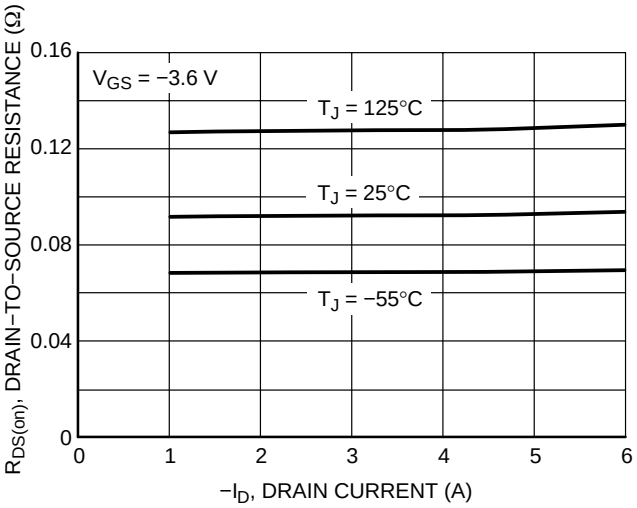



**Figure 4. On−Resistance versus Drain Current and Temperature**

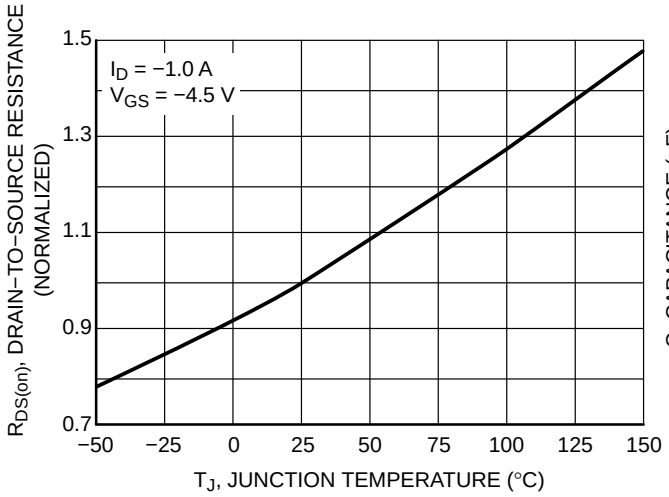



**Figure 5. On−Resistance Variation with Temperature**

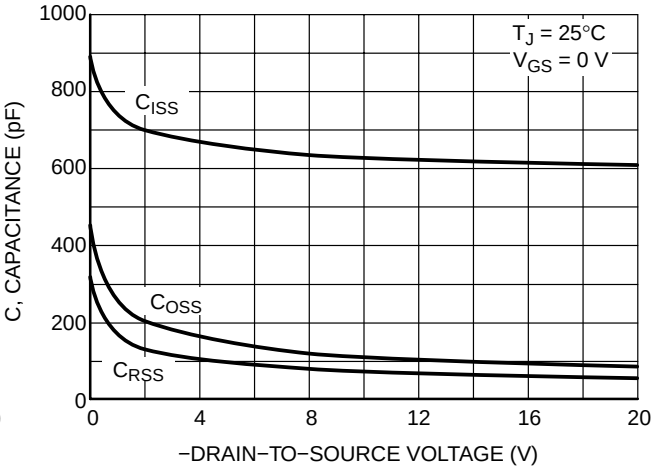



**Figure 6. Capacitance Variation**

## TYPICAL CHARACTERISTICS

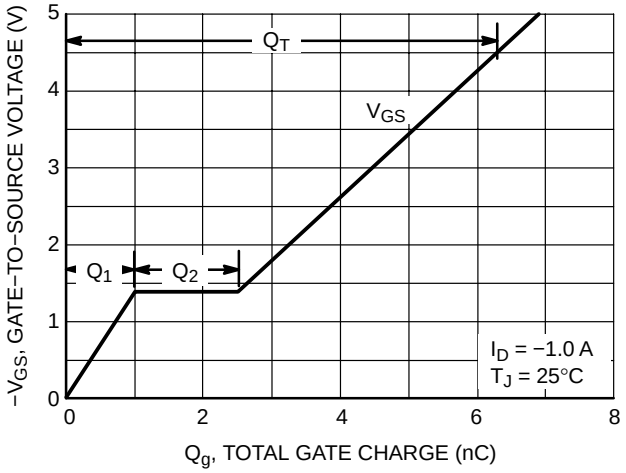



**Figure 7. Gate−to−Source and Drain−to−Source Voltage versus Total Charge**

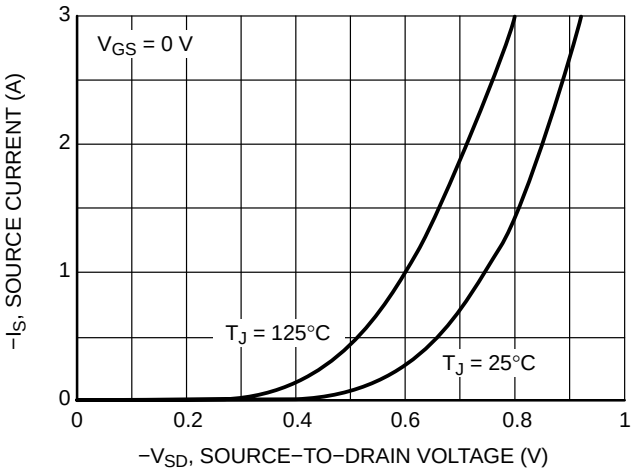
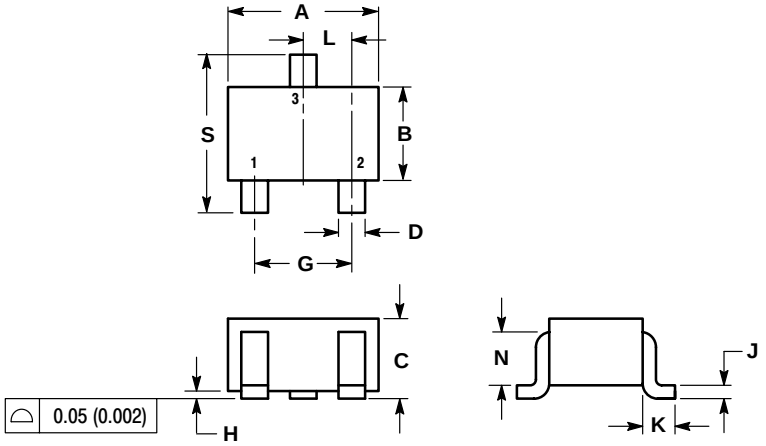



**Figure 8. Diode Forward Voltage versus Current**

## PACKAGE DIMENSIONS

**SC−70 (SOT−323)**
CASE 419−04
ISSUE L




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

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.071 | 0.087 | 1.80 | 2.20 |
| B | 0.045 | 0.053 | 1.15 | 1.35 |
| C | 0.032 | 0.040 | 0.80 | 1.00 |
| D | 0.012 | 0.016 | 0.30 | 0.40 |
| G | 0.047 | 0.055 | 1.20 | 1.40 |
| H | 0.000 | 0.004 | 0.00 | 0.10 |
| J | 0.004 | 0.010 | 0.10 | 0.25 |
| K | 0.017 REF | | 0.425 REF | |
| L | 0.026 BSC | | 0.650 BSC | |
| N | 0.028 REF | | 0.700 REF | |
| S | 0.079 | 0.095 | 2.00 | 2.40 |

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

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