

# NTJD4105C

## Small Signal MOSFET

20 V / -8.0 V, Complementary,  
+0.63 A / -0.775 A, SC-88

### Features

- Complementary N and P Channel Device
- Leading -8.0 V Trench for Low  $R_{DS(on)}$  Performance
- ESD Protected Gate – ESD Rating: Class 1
- SC-88 Package for Small Footprint (2 x 2 mm)
- Pb-Free Package May be Available. The G-Suffix Denotes a Pb-Free Lead Finish

### Applications

- DC-DC Conversion
- Load/Power Switching
- Single or Dual Cell Li-Ion Battery Supplied Devices
- Cell Phones, MP3s, Digital Cameras, PDAs

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

| Parameter   | Symbol                    | Value                  | Unit             |   |
|---|---------------------------|------------------------|------------------|---|
| Drain-to-Source Voltage   | N-Ch                      | 20                     | V                |   |
|   | P-Ch                      | -8.0                   |                  |   |
| Gate-to-Source Voltage  | N-Ch                      | $\pm 12$               | V                |   |
|   | P-Ch                      | $\pm 8.0$              |                  |   |
| Continuous Drain Current – Steady State (Based on $R_{\theta JA}$ ) | N-Ch                      | $T_A=25^\circ\text{C}$ | 0.63             | A |
|   |                           | $T_A=85^\circ\text{C}$ | 0.46             |   |
|   | P-Ch                      | $T_A=25^\circ\text{C}$ | -0.775           |   |
|   |                           | $T_A=85^\circ\text{C}$ | -0.558           |   |
| Continuous Drain Current – Steady State (Based on $R_{\theta JL}$ ) | N-Ch                      | $T_A=25^\circ\text{C}$ | 0.91             |   |
|   |                           | $T_A=85^\circ\text{C}$ | 0.65             |   |
|   | P-Ch                      | $T_A=25^\circ\text{C}$ | -1.1             |   |
|   |                           | $T_A=85^\circ\text{C}$ | -0.8             |   |
| Pulsed Drain Current  | $t_p \leq 10 \mu\text{s}$ | $I_{DM}$               | $\pm 1.2$        | A |
| Power Dissipation – Steady State (Based on $R_{\theta JA}$ )        | $T_A=25^\circ\text{C}$    | $P_D$                  | 0.27             | W |
|   | $T_A=85^\circ\text{C}$    |                        | 0.14             |   |
| Power Dissipation – Steady State (Based on $R_{\theta JL}$ )        | $T_A=25^\circ\text{C}$    |                        | 0.55             |   |
|   | $T_A=85^\circ\text{C}$    |                        | 0.29             |   |
| Operating Junction and Storage Temperature                          | $T_J, T_{STG}$            | -55 to 150             | $^\circ\text{C}$ |   |
| Source Current (Body Diode)   | N-Ch                      | $I_S$                  | 0.63             | A |
|   | P-Ch                      |                        | -0.775           |   |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s)   | $T_L$                     | 260                    | $^\circ\text{C}$ |   |

### THERMAL RESISTANCE RATINGS (Note 1)

| Parameter                               | Typ | Max | Unit               |
|---|-----|-----|--------------------|
| Junction-to-Ambient – Steady State      | Typ | 400 | $^\circ\text{C/W}$ |
|   | Max | 460 |                    |
| Junction-to-Lead (Drain) – Steady State | Typ | 194 |                    |
|   | Max | 226 |                    |

1. Surface mounted on FR4 board using 1 oz Cu area = 0.9523 in sq.

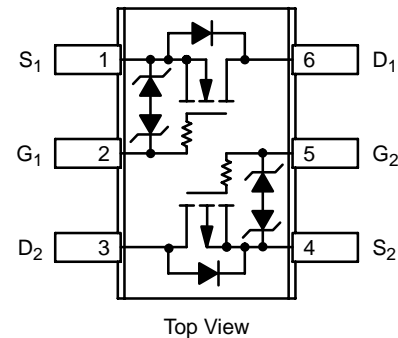


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| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP       | $I_D$ MAX |
|---------------|------------------------|-----------|
| N-Ch 20 V     | 0.29 $\Omega$ @ 4.5 V  | 0.63 A    |
|               | 0.36 $\Omega$ @ 2.5 V  |           |
| P-Ch -8.0 V   | 0.22 $\Omega$ @ -4.5 V | -0.775 A  |
|               | 0.32 $\Omega$ @ -2.5 V |           |
|               | 0.51 $\Omega$ @ -1.8 V |           |

### SOT-363 SC-88 (6-LEADS)

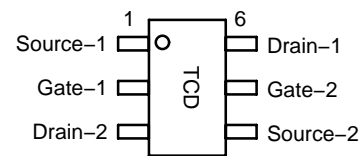


Top View



### SC-88 (SOT-363) CASE 419B Style 26

### MARKING DIAGRAM & PIN ASSIGNMENT



Top View

TC = Specific Device Code  
D = Date Code

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

# NTJD4105C

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

| Parameter   | Symbol                                | N/P | Test Condition                                | Min                     | Typ  | Max   | Units |
|---|---------------------------------------|-----|---|-------------------------|------|-------|-------|
| <b>OFF CHARACTERISTICS</b>                                |                                       |     |   |                         |      |       |       |
| Drain-to-Source Breakdown Voltage                         | V <sub>(BR)DSS</sub>                  | N   | V <sub>GS</sub> =0 V                          | I <sub>D</sub> =250 μA  | 20   | 27    | V     |
|   |                                       | P   |   | I <sub>D</sub> =-250 μA | -8.0 | -10.5 |       |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V <sub>(BR)DSS</sub> / T <sub>J</sub> | N   |   |                         | 22   |       | mV/°C |
|   |                                       | P   |   |                         | -6.0 |       |       |
| Zero Gate Voltage Drain Current                           | I <sub>DSS</sub>                      | N   | V <sub>GS</sub> =0 V, V <sub>DS</sub> =16 V   | T <sub>J</sub> =25 °C   |      | 1.0   | μA    |
|   |                                       | P   | V <sub>GS</sub> =0 V, V <sub>DS</sub> =-6.4 V |                         |      | 1.0   |       |
| Gate-to-Source Leakage Current                            | I <sub>GSS</sub>                      | N   | V <sub>DS</sub> =0 V                          | V <sub>GS</sub> =±12 V  |      | 10    | μA    |
|   |                                       | P   |   | V <sub>GS</sub> =±8.0   |      | 10    |       |

## 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> =250 μA  | 0.6   | 0.92  | 1.5  | V      |
|  |                                      | P |  | I <sub>D</sub> =-250 μA | -0.45 | -0.83 | -1.0 |        |
| Gate Threshold Temperature Coefficient | V <sub>GS(TH)</sub> / T <sub>J</sub> | N |  |                         |       | -2.1  |      | -mV/°C |
|  |                                      | P |  |                         |       | 2.2   |      |        |
| Drain-to-Source On Resistance          | R <sub>DS(on)</sub>                  | N | V <sub>GS</sub> =4.5 V, I <sub>D</sub> =0.63 A   |                         | 0.29  | 0.375 | Ω    |        |
|  |                                      | P | V <sub>GS</sub> =-4.5 V, I <sub>D</sub> =-0.57 A |                         | 0.22  | 0.30  |      |        |
|  |                                      | N | V <sub>GS</sub> =2.5 V, I <sub>D</sub> =0.40 A   |                         | 0.36  | 0.445 |      |        |
|  |                                      | P | V <sub>GS</sub> =-2.5 V, I <sub>D</sub> =-0.48 A |                         | 0.32  | 0.46  |      |        |
|  |                                      | P | V <sub>GS</sub> =-1.8 V, I <sub>D</sub> =-0.20 A |                         | 0.51  | 0.90  |      |        |
| Forward Transconductance               | g <sub>FS</sub>                      | N | V <sub>DS</sub> =4.0 V, I <sub>D</sub> =0.63 A   |                         | 2.0   |       | S    |        |
|  |                                      | P | V <sub>DS</sub> =-4.0 V, I <sub>D</sub> =-0.57 A |                         | 2.0   |       |      |        |

## CHARGES AND CAPACITANCES

|                              |                     |   |  |  |     |     |    |    |
|------------------------------|---------------------|---|--|--|-----|-----|----|----|
| Input Capacitance            | C <sub>ISS</sub>    | N | f=1 MHz, V <sub>GS</sub> =0 V  | V <sub>DS</sub> =20 V  | 33  | 46  | pF |    |
|                              |                     | P |  | V <sub>DS</sub> =-8.0V   | 160 | 225 |    |    |
| Output Capacitance           | C <sub>OSS</sub>    | N |  | V <sub>DS</sub> =20 V  | 13  | 22  |    |    |
|                              |                     | P |  | V <sub>DS</sub> =-8.0 V  | 38  | 55  |    |    |
| Reverse Transfer Capacitance | C <sub>RSS</sub>    | N |  | V <sub>DS</sub> =20 V  | 2.8 | 5.0 |    |    |
|                              |                     | P |  | V <sub>DS</sub> =-8.0 V  | 28  | 40  |    |    |
| Total Gate Charge            | Q <sub>G(TOT)</sub> | N |  | V <sub>GS</sub> =4.5 V, V <sub>DS</sub> =10 V, I <sub>D</sub> =0.7 A     | 1.3 | 3.0 |    | nC |
|                              |                     | P |  | V <sub>GS</sub> =-4.5 V, V <sub>DS</sub> =-5.0 V, I <sub>D</sub> =-0.6 A | 2.2 | 4.0 |    |    |
| Threshold Gate Charge        | Q <sub>G(TH)</sub>  | N |  | V <sub>GS</sub> =4.5 V, V <sub>DS</sub> =10 V, I <sub>D</sub> =0.7 A     | 0.1 |     |    |    |
|                              |                     | P |  | V <sub>GS</sub> =-4.5 V, V <sub>DS</sub> =-5.0 V, I <sub>D</sub> =-0.6 A | 0.1 |     |    |    |
| Gate-to-Source Charge        | Q <sub>GS</sub>     | N | V <sub>GS</sub> =4.5 V, V <sub>DS</sub> =10 V, I <sub>D</sub> =0.7 A     | 0.2  |     |     |    |    |
|                              |                     | P | V <sub>GS</sub> =-4.5 V, V <sub>DS</sub> =-5.0 V, I <sub>D</sub> =-0.6 A | 0.5  |     |     |    |    |
| Gate-to-Drain Charge         | Q <sub>GD</sub>     | N | V <sub>GS</sub> =4.5 V, V <sub>DS</sub> =10 V, I <sub>D</sub> =0.7 A     | 0.4  |     |     |    |    |
|                              |                     | P | V <sub>GS</sub> =-4.5 V, V <sub>DS</sub> =-5.0 V, I <sub>D</sub> =-0.6 A | 0.5  |     |     |    |    |

## 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> =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 |  |    |
| Turn-On Delay Time  | t <sub>d(ON)</sub>  | P | V <sub>GS</sub> =-4.5 V, V <sub>DD</sub> =-4.0 V, I <sub>D</sub> =-0.5 A, R <sub>G</sub> =8.0 Ω | 0.013 |  |    |
| Rise Time           | t <sub>r</sub>      |   |   | 0.023 |  |    |
| Turn-Off Delay Time | t <sub>d(OFF)</sub> |   |   | 0.050 |  |    |
| Fall Time           | t <sub>f</sub>      |   |   | 0.036 |  |    |

## DRAIN-SOURCE DIODE CHARACTERISTICS

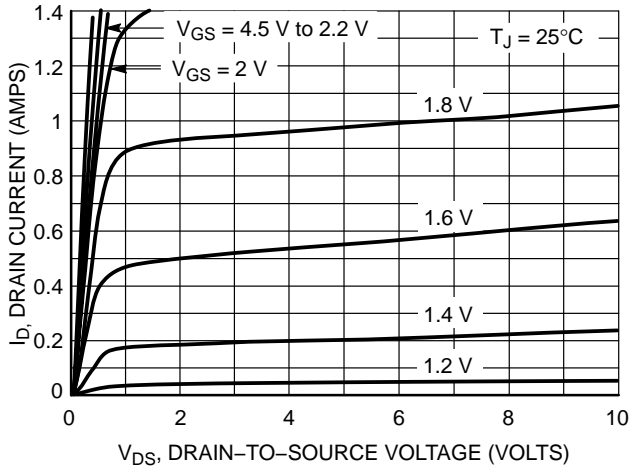
|                       |                 |   |   |                         |       |     |    |
|-----------------------|-----------------|---|---|-------------------------|-------|-----|----|
| Forward Diode Voltage | V <sub>SD</sub> | N | V <sub>GS</sub> =0 V, T <sub>J</sub> =25°C        | I <sub>S</sub> =0.23 A  | 0.76  | 1.1 | V  |
|                       |                 | P |   | I <sub>S</sub> =-0.23 A | 0.76  | 1.1 |    |
|                       |                 | N | V <sub>GS</sub> =0 V, T <sub>J</sub> =125°C       | I <sub>S</sub> =0.23 A  | 0.63  |     |    |
|                       |                 | P |   | I <sub>S</sub> =-0.23 A | 0.63  |     |    |
| Reverse Recovery Time | t <sub>RR</sub> | N | V <sub>GS</sub> =0 V, dI <sub>S</sub> /dt=90 A/μs | I <sub>S</sub> =0.23 A  | 0.410 |     | μs |
|                       |                 | P |   | I <sub>S</sub> =-0.23 A | 0.078 |     |    |

2. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

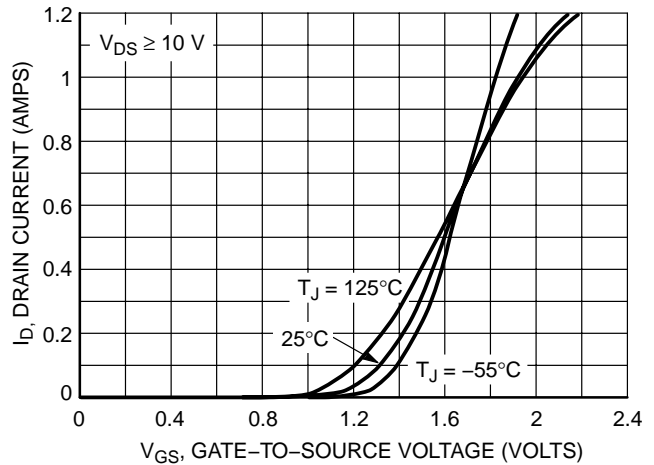
3. Switching characteristics are independent of operating junction temperatures.

# NTJD4105C

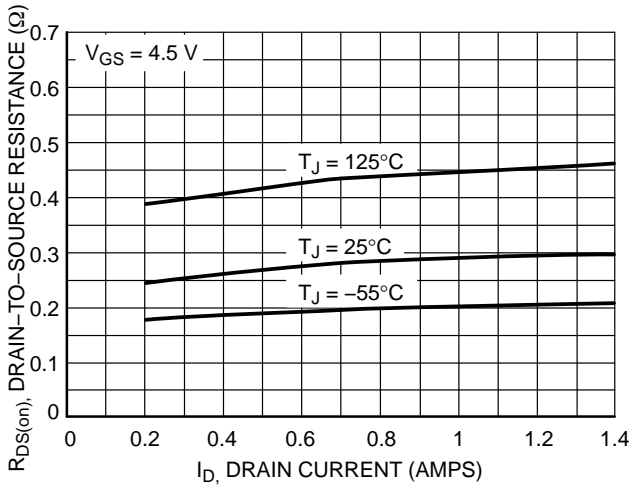
## TYPICAL N-CHANNEL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)



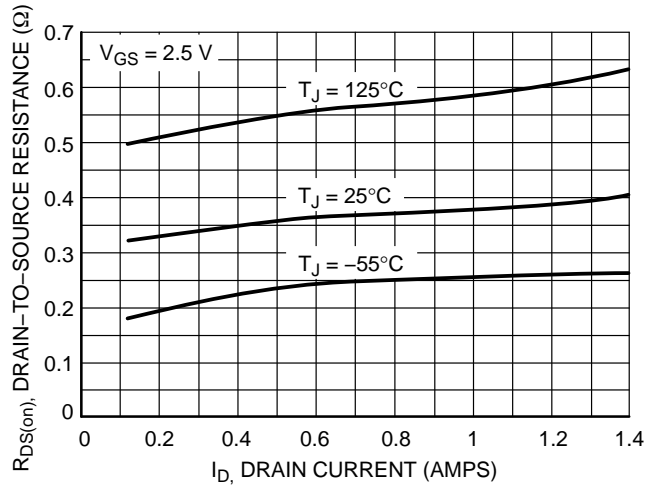
**Figure 1. On-Region Characteristics**



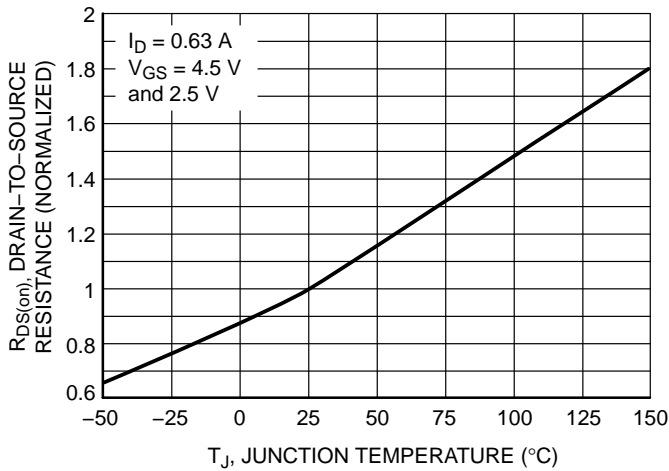
**Figure 2. Transfer Characteristics**



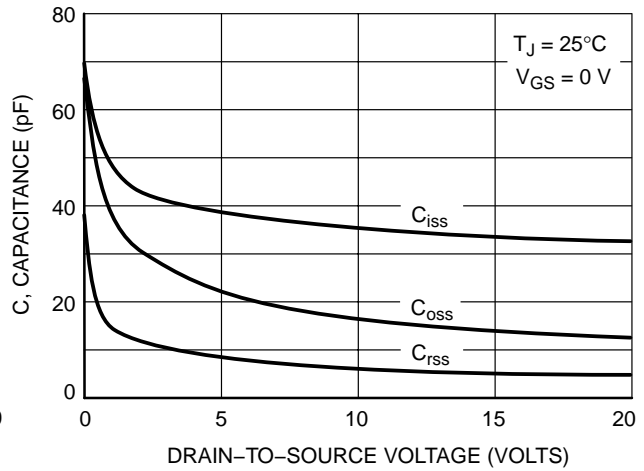
**Figure 3. On-Resistance vs. Drain Current and Temperature**



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



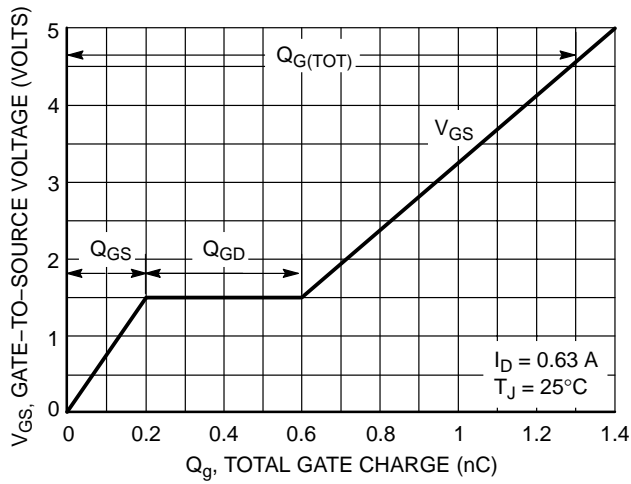
**Figure 5. On-Resistance Variation with Temperature**



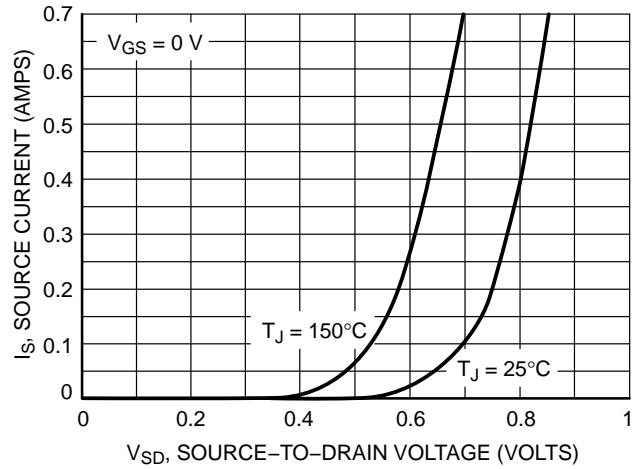
**Figure 6. Capacitance Variation**

# NTJD4105C

## TYPICAL N-CHANNEL 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**

# NTJD4105C

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

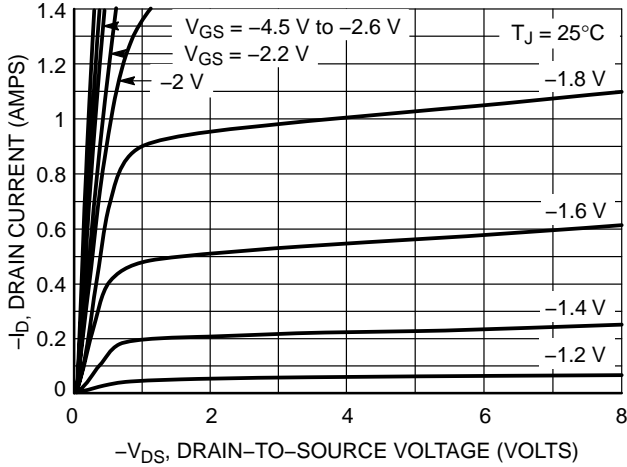


Figure 9. On-Region Characteristics

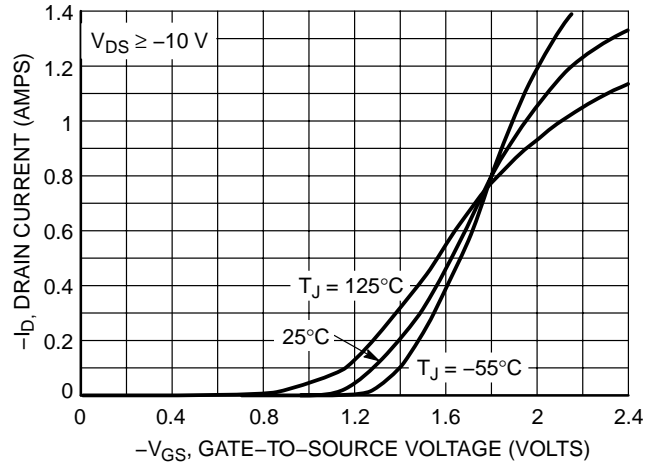


Figure 10. Transfer Characteristics

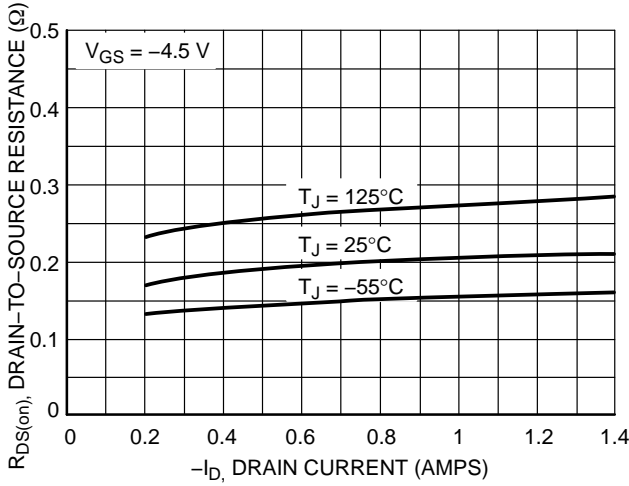


Figure 11. On-Resistance vs. Drain Current and Temperature

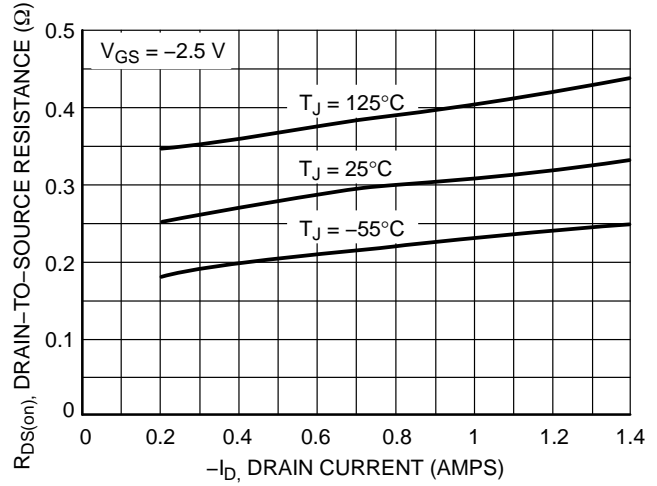


Figure 12. On-Resistance vs. Drain Current and Temperature

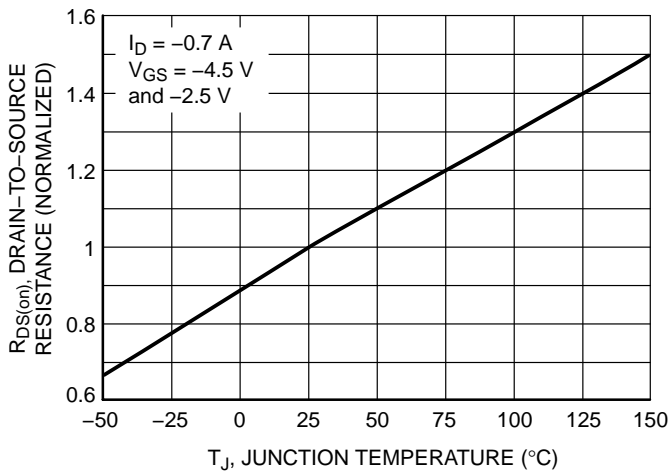


Figure 13. On-Resistance Variation with Temperature

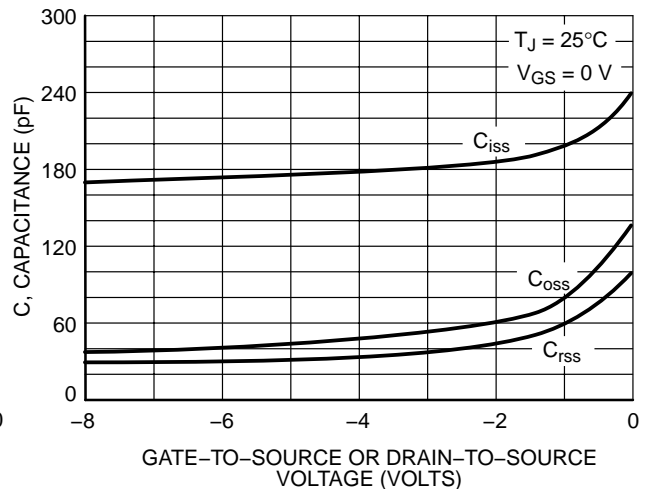
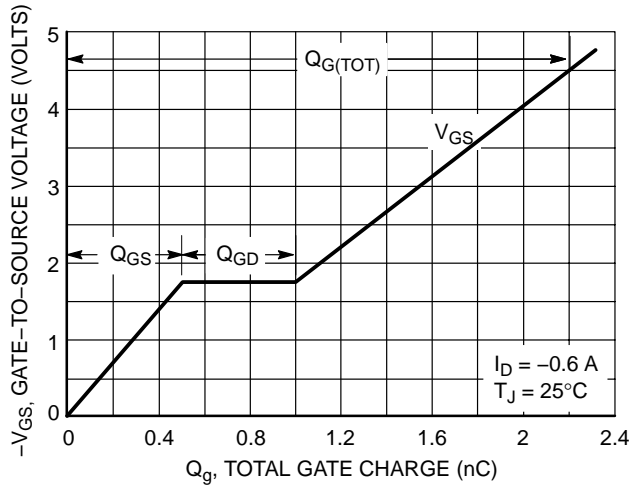


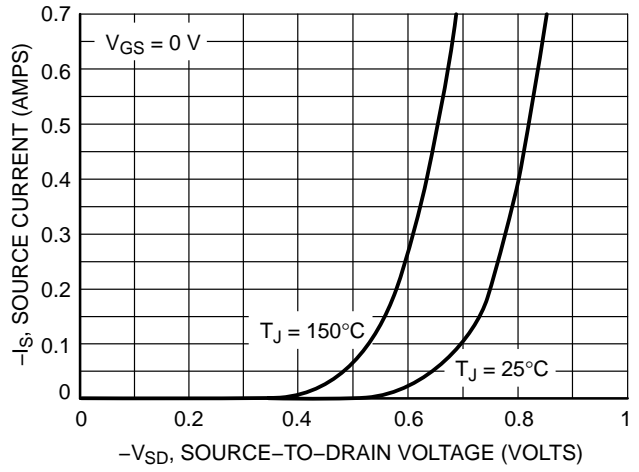
Figure 14. Capacitance Variation

# NTJD4105C

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



**Figure 15. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



**Figure 16. Diode Forward Voltage vs. Current**

# NTJD4105C

## ORDERING INFORMATION1

| Device       | Package              | Shipping†            |
|--------------|----------------------|----------------------|
| NTJD4105CT1  | SOT-363              | 3000 / Tape & Reel   |
| NTJD4105CT1G | SOT-363<br>(Pb-Free) | 3000 / Tape & Reel   |
| NTJD4105CT2  | SOT-363              | 3000 / Tape & Reel   |
| NTJD4105CT2G | SOT-363<br>(Pb-Free) | 3000 / Tape & Reel   |
| NTJD4105CT4  | SOT-363              | 10,000 / Tape & Reel |
| NTJD4105CT4G | SOT-363<br>(Pb-Free) | 10,000 / Tape & Reel |

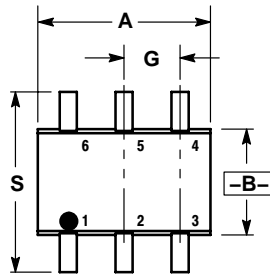
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# NTJD4105C

## PACKAGE DIMENSIONS

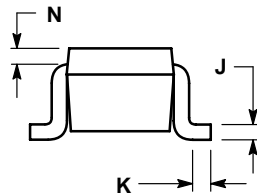
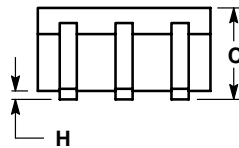
### SC-88 (SOT-363) CASE 419B-02 ISSUE T

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



D 6 PL

⊕ 0.2 (0.008) (M) B (M)

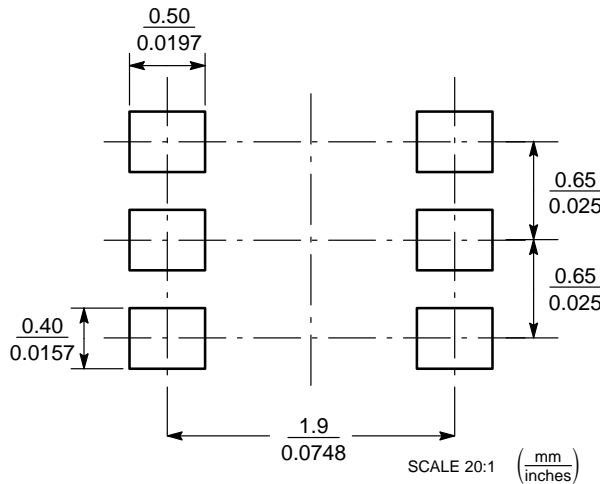


| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.071     | 0.087 | 1.80        | 2.20 |
| B   | 0.045     | 0.053 | 1.15        | 1.35 |
| C   | 0.031     | 0.043 | 0.80        | 1.10 |
| D   | 0.004     | 0.012 | 0.10        | 0.30 |
| G   | 0.026 BSC |       | 0.65 BSC    |      |
| H   | ---       | 0.004 | ---         | 0.10 |
| J   | 0.004     | 0.010 | 0.10        | 0.25 |
| K   | 0.004     | 0.012 | 0.10        | 0.30 |
| N   | 0.008 REF |       | 0.20 REF    |      |
| S   | 0.079     | 0.087 | 2.00        | 2.20 |

STYLE 26:

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

### SOLDERING FOOTPRINT\*



### SC-88/SC70-6

\*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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