

# NTGD3149C

## Power MOSFET

Complementary, 20 V, +3.5/-2.7 A,  
TSOP-6 Dual

### Features

- Complementary N-Channel and P-Channel MOSFET
- Small Size (3 x 3 mm) Dual TSOP-6 Package
- Leading Edge Trench Technology for Low On Resistance
- Reduced Gate Charge to Improve Switching Response
- Independently Connected Devices to Provide Design Flexibility
- This is a Pb-Free Device

### Applications

- DC-DC Conversion Circuits
- Load/Power Switching with Level Shift

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

| Parameter                                                            |              |                                                      | Symbol         | Value      | Unit             |
|----------------------------------------------------------------------|--------------|------------------------------------------------------|----------------|------------|------------------|
| Drain-to-Source Voltage                                              |              |                                                      | $V_{DS}$       | 20         | V                |
| Gate-to-Source Voltage (N-Ch & P-Ch)                                 |              |                                                      | $V_{GS}$       | $\pm 8$    | V                |
| N-Channel<br>Continuous Drain<br>Current (Note 1)                    | Steady State | $T_A = 25^\circ\text{C}$<br>$T_A = 85^\circ\text{C}$ | $I_D$          | 3.2<br>2.3 | A                |
|                                                                      | $t \leq 5$ s | $T_A = 25^\circ\text{C}$                             |                | 3.5        |                  |
|                                                                      |              |                                                      |                |            |                  |
| P-Channel<br>Continuous Drain<br>Current (Note 1)                    | Steady State | $T_A = 25^\circ\text{C}$<br>$T_A = 85^\circ\text{C}$ | $I_D$          | 2.4<br>1.7 | A                |
|                                                                      | $t \leq 5$ s | $T_A = 25^\circ\text{C}$                             |                | 2.7        |                  |
|                                                                      |              |                                                      |                |            |                  |
| Power Dissipation<br>(Note 1)                                        | Steady State | $T_A = 25^\circ\text{C}$                             | $P_D$          | 0.9        | W                |
|                                                                      | $t \leq 5$ s |                                                      |                | 1.1        |                  |
| Pulsed Drain<br>Current                                              | N-Ch         | $t_p = 10$ $\mu\text{s}$                             | $I_{DM}$       | 11         | A                |
|                                                                      | P-Ch         |                                                      |                | 8.0        |                  |
| Operating Junction and Storage Temperature                           |              |                                                      | $T_J, T_{STG}$ | -55 to 150 | $^\circ\text{C}$ |
| Source Current (Body Diode)                                          |              |                                                      | $I_S$          | 0.8        | A                |
| Lead Temperature for Soldering Purposes<br>(1/8" from case for 10 s) |              |                                                      | $T_L$          | 260        | $^\circ\text{C}$ |

### THERMAL RESISTANCE RATINGS

| Parameter                                   | Symbol          | Value | Unit               |
|---------------------------------------------|-----------------|-------|--------------------|
| Junction-to-Ambient – Steady State (Note 1) | $R_{\theta JA}$ | 140   | $^\circ\text{C/W}$ |
| Junction-to-Ambient – $t \leq 5$ s (Note 1) | $R_{\theta JA}$ | 110   | $^\circ\text{C/W}$ |

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.

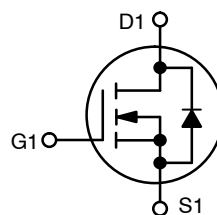
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).



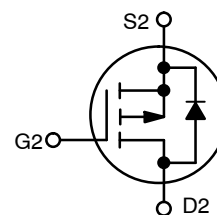
ON Semiconductor®

<http://onsemi.com>

| $V_{(BR)DS}$  | $R_{DS(on)}$ MAX       | $I_D$ MAX (Note 1) |
|---------------|------------------------|--------------------|
| N-Ch<br>20 V  | 60 m $\Omega$ @ 4.5 V  | 3.5 A              |
|               | 90 m $\Omega$ @ 2.5 V  |                    |
| P-Ch<br>-20 V | 110 m $\Omega$ @ 4.5 V | -2.7 A             |
|               | 145 m $\Omega$ @ 2.5 V |                    |



N-CHANNEL MOSFET

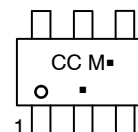


P-CHANNEL MOSFET



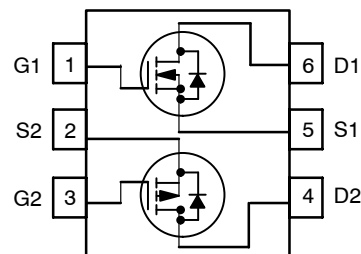
TSOP-6  
CASE 318G  
STYLE 13

### MARKING DIAGRAM



CC = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package  
(Note: Microdot may be in either location)

### PIN CONNECTION



(Top View)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

# NTGD3149C

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

| Parameter | Symbol | N/P | Test Conditions | Min | Typ | Max | Unit |
|-----------|--------|-----|-----------------|-----|-----|-----|------|
|-----------|--------|-----|-----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|                                                           |                                      |   |                                                |                          |     |      |       |
|-----------------------------------------------------------|--------------------------------------|---|------------------------------------------------|--------------------------|-----|------|-------|
| Drain-to-Source Breakdown Voltage                         | V <sub>(BR)DSS</sub>                 | N | V <sub>GS</sub> = 0 V                          | I <sub>D</sub> = 250 μA  | 20  |      | V     |
|                                                           |                                      | P |                                                | I <sub>D</sub> = -250 μA | -20 |      |       |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V <sub>(BR)DSS</sub> /T <sub>J</sub> | N |                                                |                          | 1.1 |      | mV/°C |
|                                                           |                                      | P |                                                |                          | 1.1 |      |       |
| 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> = -16 V |                          |     | -1.0 |       |
|                                                           |                                      | N | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 16 V  | T <sub>J</sub> = 85 °C   |     | 10   |       |
|                                                           |                                      | P | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = -16 V |                          |     | -10  |       |
| Gate-to-Source Leakage Current                            | I <sub>GSS</sub>                     | N | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±8 V  |                          |     | ±100 | nA    |
|                                                           |                                      | P | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±8 V  |                          |     | ±100 |       |

### 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  | 0.4  | 1.0  | V  |
|                               |                     | P |                                                   | I <sub>D</sub> = -250 μA | -0.4 | -1.0 |    |
| Drain-to-Source On Resistance | R <sub>DS(on)</sub> | N | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 3.5 A   |                          | 41   | 60   | mΩ |
|                               |                     | P | V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -2.7 A |                          | 83   | 110  |    |
|                               |                     | N | V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 2.9 A   |                          | 51   | 90   |    |
|                               |                     | P | V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -2.4 A |                          | 104  | 145  |    |
|                               |                     | N | V <sub>GS</sub> = 1.8 V, I <sub>D</sub> = 2.2 A   |                          | 67   | 150  |    |
|                               |                     | P | V <sub>GS</sub> = -1.8 V, I <sub>D</sub> = -1.9 A |                          | 143  | 220  |    |
| Forward Transconductance      | g <sub>FS</sub>     | N | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 3.5 A    |                          | 4.7  |      | S  |
|                               |                     | P | V <sub>DS</sub> = -10 V, I <sub>D</sub> = -2.7 A  |                          | 5.1  |      |    |

### CHARGES AND CAPACITANCES

|                               |                     |   |                                                                                                    |                         |     |     |    |    |
|-------------------------------|---------------------|---|----------------------------------------------------------------------------------------------------|-------------------------|-----|-----|----|----|
| Input Capacitance             | C <sub>ISS</sub>    | N | f = 1 MHz, V <sub>GS</sub> = 0 V                                                                   | V <sub>DS</sub> = 10 V  |     | 387 |    | pF |
| Output Capacitance            | C <sub>OSS</sub>    |   |                                                                                                    |                         |     | 73  |    |    |
| Reverse Transfer Capacitance  | C <sub>RSS</sub>    |   |                                                                                                    |                         |     | 43  |    |    |
| Input Capacitance             | C <sub>ISS</sub>    | P |                                                                                                    | V <sub>DS</sub> = -10 V |     | 509 |    |    |
| Output Capacitance            | C <sub>OSS</sub>    |   |                                                                                                    |                         |     | 76  |    |    |
| Reverse Transfer Capacitance  | C <sub>RSS</sub>    |   |                                                                                                    |                         |     | 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> = 2.0 A<br>R <sub>G</sub> = 6 Ω    |                         | 4.6 | 5.5 | nC |    |
| Threshold Gate Charge         | Q <sub>G(TH)</sub>  |   |                                                                                                    |                         | 0.3 |     |    |    |
| Gate-to-Source Gate Charge    | Q <sub>GS</sub>     |   |                                                                                                    |                         | 0.7 |     |    |    |
| Gate-to-Drain "Miller" Charge | Q <sub>GD</sub>     |   |                                                                                                    |                         | 1.2 |     |    |    |
| Total Gate Charge             | Q <sub>G(TOT)</sub> | P | V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -10 V, I <sub>D</sub> = -1.0 A<br>R <sub>G</sub> = 6 Ω |                         | 5.2 | 5.5 |    |    |
| Threshold Gate Charge         | Q <sub>G(TH)</sub>  |   |                                                                                                    |                         | 0.4 |     |    |    |
| Gate-to-Source Gate Charge    | Q <sub>GS</sub>     |   |                                                                                                    |                         | 1.0 |     |    |    |
| Gate-to-Drain "Miller" Charge | Q <sub>GD</sub>     |   |                                                                                                    |                         | 1.2 |     |    |    |

# NTGD3149C

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

| Parameter | Symbol | N/P | Test Conditions | Min | Typ | Max | Unit |
|-----------|--------|-----|-----------------|-----|-----|-----|------|
|-----------|--------|-----|-----------------|-----|-----|-----|------|

### SWITCHING CHARACTERISTICS (Note 3)

|                     |              |   |                                                                                              |  |      |  |    |
|---------------------|--------------|---|----------------------------------------------------------------------------------------------|--|------|--|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | N | $V_{GS} = 4.5\text{ V}, V_{DD} = 10\text{ V},$<br>$I_D = 1.0\text{ A}, R_G = 6.0\ \Omega$    |  | 6.5  |  | ns |
| Rise Time           | $t_r$        |   |                                                                                              |  | 3.8  |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |   |                                                                                              |  | 16.4 |  |    |
| Fall Time           | $t_f$        |   |                                                                                              |  | 2.4  |  |    |
| Turn-On Delay Time  | $t_{d(ON)}$  | P | $V_{GS} = -4.5\text{ V}, V_{DD} = -10\text{ V},$<br>$I_D = -1.0\text{ A}, R_G = 6.0\ \Omega$ |  | 7.0  |  |    |
| Rise Time           | $t_r$        |   |                                                                                              |  | 5.3  |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |   |                                                                                              |  | 33.3 |  |    |
| Fall Time           | $t_f$        |   |                                                                                              |  | 29.5 |  |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |          |   |                                                             |                       |  |      |      |    |
|-------------------------|----------|---|-------------------------------------------------------------|-----------------------|--|------|------|----|
| Forward Diode Voltage   | $V_{SD}$ | N | $V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$               | $I_S = 0.8\text{ A}$  |  | 0.7  | 1.2  | V  |
|                         |          | P |                                                             | $I_S = -0.8\text{ A}$ |  | -0.7 | -1.2 |    |
| Reverse Recovery Time   | $t_{RR}$ | N | $V_{GS} = 0\text{ V}, dI_S / dt = 100\text{ A}/\mu\text{s}$ |                       |  | 7.7  |      | ns |
| Charge Time             | $t_a$    |   |                                                             |                       |  | 4.5  |      |    |
| Discharge Time          | $t_b$    |   |                                                             |                       |  | 3.2  |      |    |
| Reverse Recovery Charge | $Q_{RR}$ |   |                                                             |                       |  | 1.9  |      |    |
| Reverse Recovery Time   | $t_{RR}$ | P | $V_{GS} = 0\text{ V}, dI_S / dt = 100\text{ A}/\mu\text{s}$ |                       |  | 11.4 |      | ns |
| Charge Time             | $t_a$    |   |                                                             |                       |  | 7.5  |      |    |
| Discharge Time          | $t_b$    |   |                                                             |                       |  | 3.9  |      |    |
| Reverse Recovery Charge | $Q_{RR}$ |   |                                                             |                       |  | 4.7  |      |    |

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

3. Switching characteristics are independent of operating junction temperatures.

## ORDERING INFORMATION

| Device       | Package            | Shipping <sup>†</sup> |
|--------------|--------------------|-----------------------|
| NTGD3149CT1G | TSOP6<br>(Pb-Free) | 3000 / 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.

TYPICAL CHARACTERISTICS (N-CHANNEL)

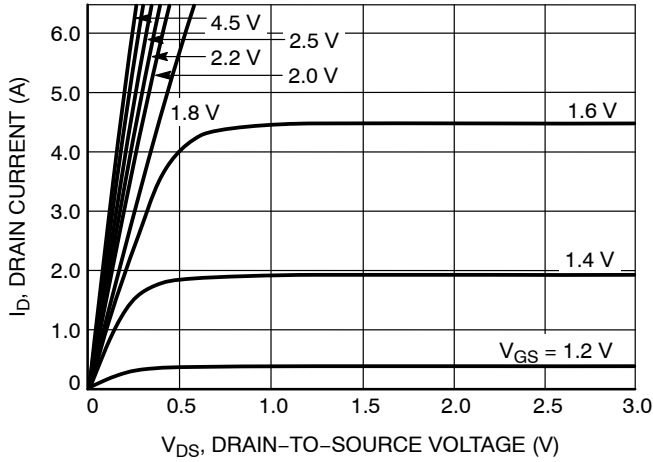


Figure 1. Nch On-Region Characteristics

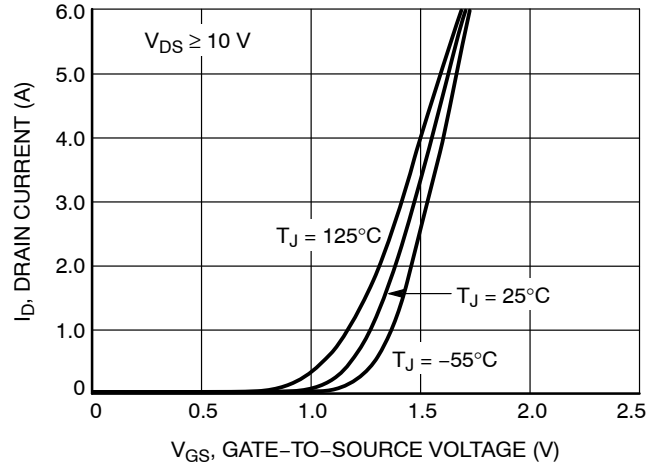


Figure 2. Nch Transfer Characteristics

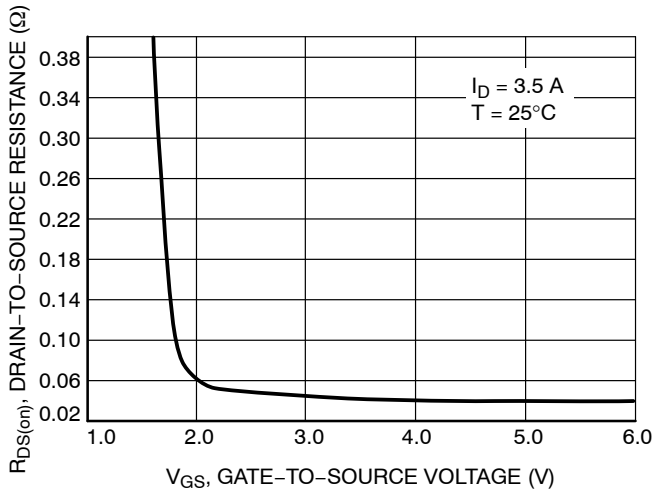


Figure 3. Nch On-Resistance vs. Gate Voltage

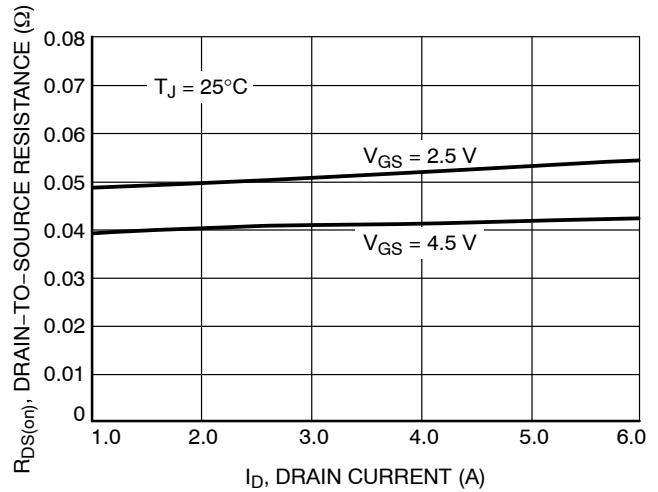


Figure 4. Nch On-Resistance vs. Drain Current and Gate Voltage

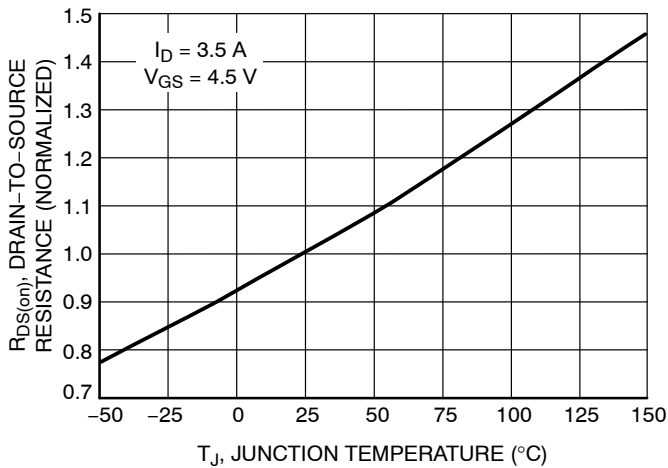


Figure 5. Nch On-Resistance Variation with Temperature

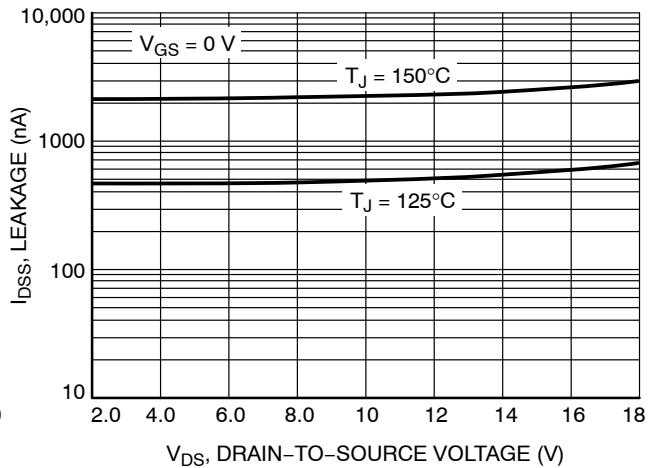


Figure 6. Nch Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS (N-CHANNEL)

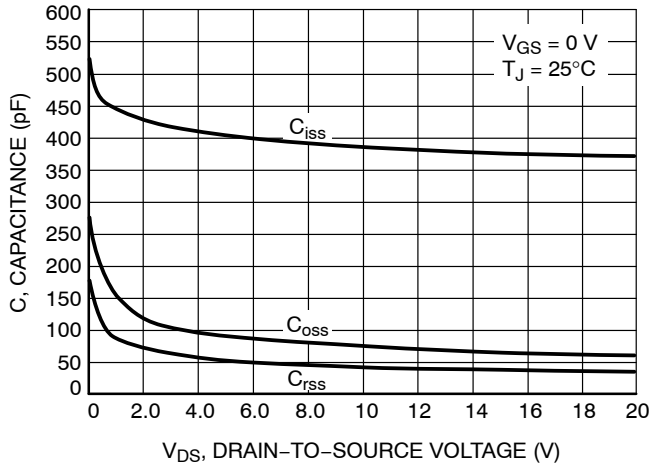


Figure 7. Nch Capacitance Variation

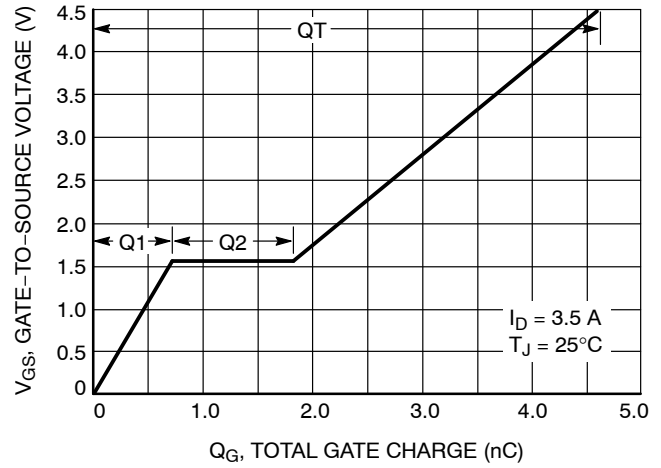


Figure 8. Nch Gate-to-Source Voltage vs. Total Charge

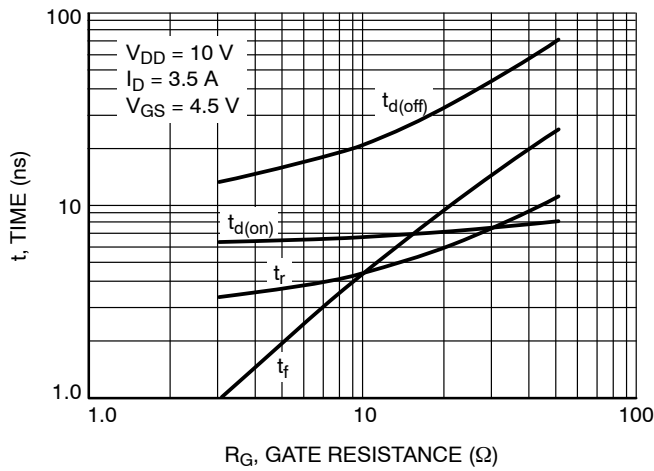


Figure 9. Nch Resistive Switching Time Variation vs. Gate Resistance

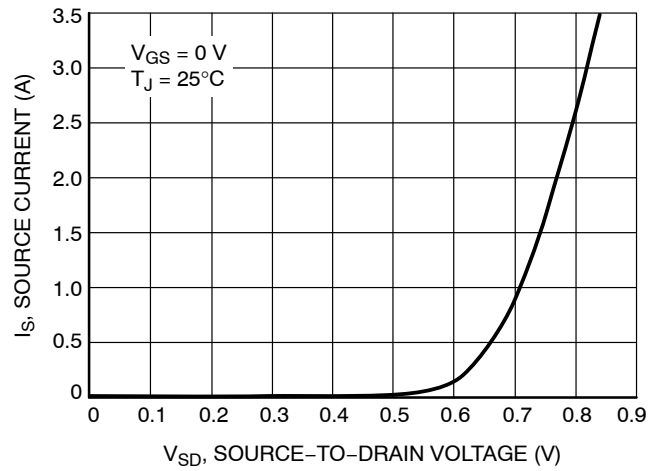


Figure 10. Nch Diode Forward Voltage vs. Current

TYPICAL CHARACTERISTICS (P-CHANNEL)

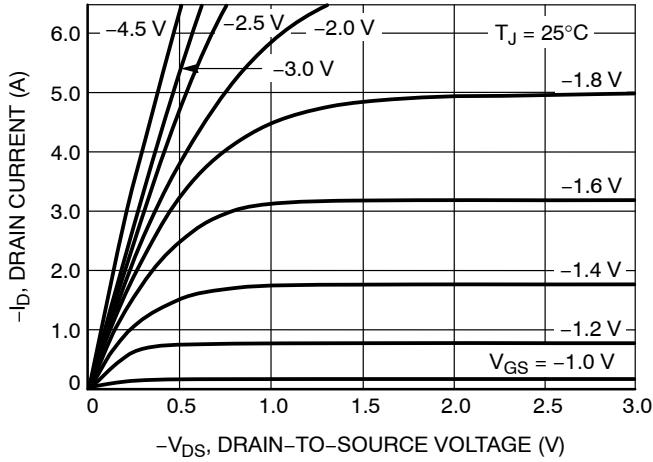


Figure 11. Pch On-Region Characteristics

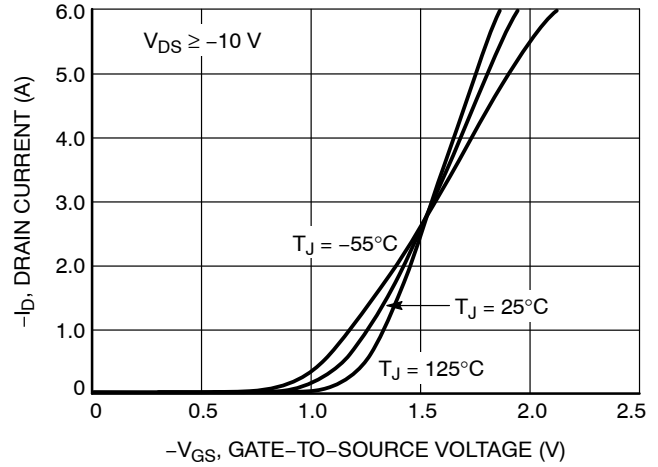


Figure 12. Pch Transfer Characteristics

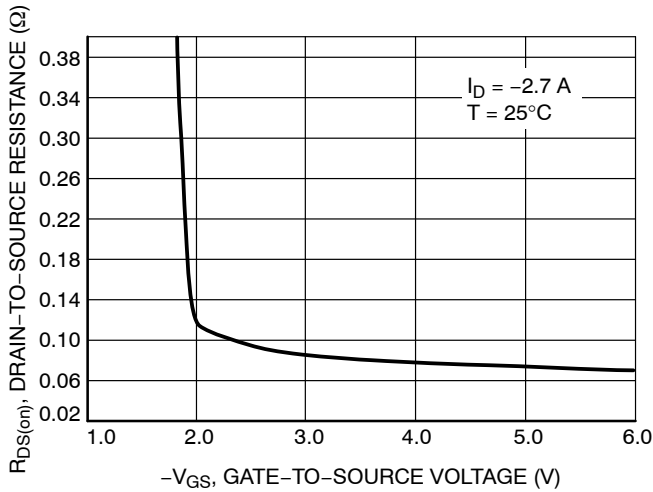


Figure 13. Pch On-Resistance vs. Gate Voltage

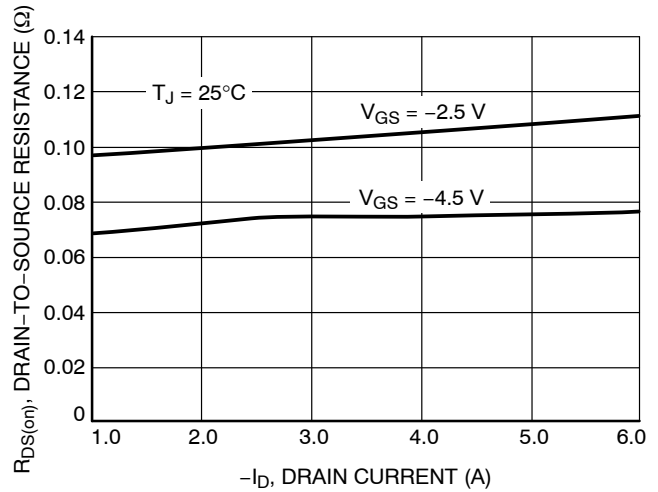


Figure 14. Pch On-Resistance vs. Drain Current and Gate Voltage

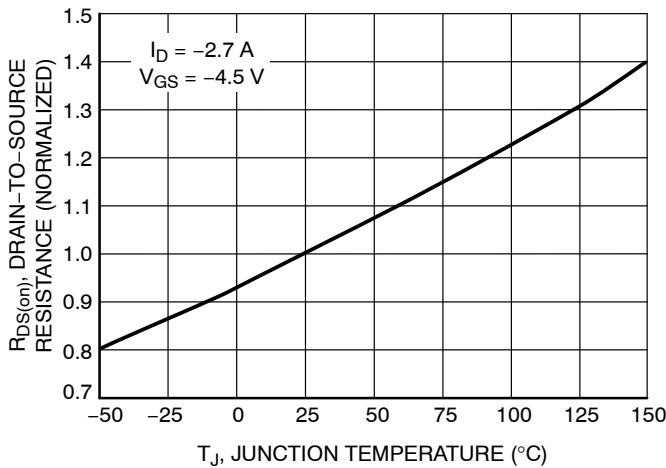


Figure 15. Pch On-Resistance Variation with Temperature

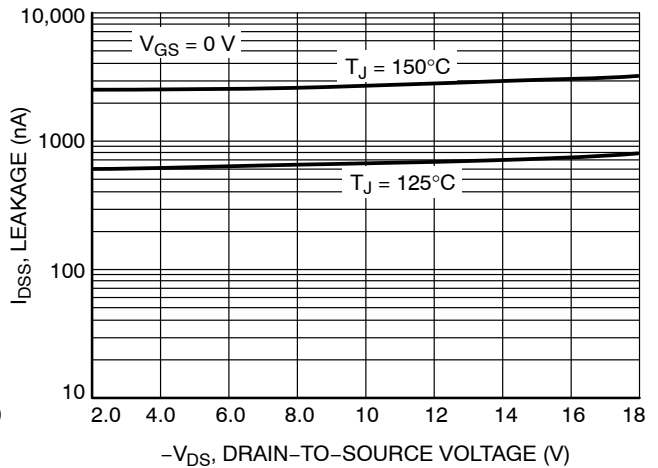


Figure 16. Pch Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS (P-CHANNEL)

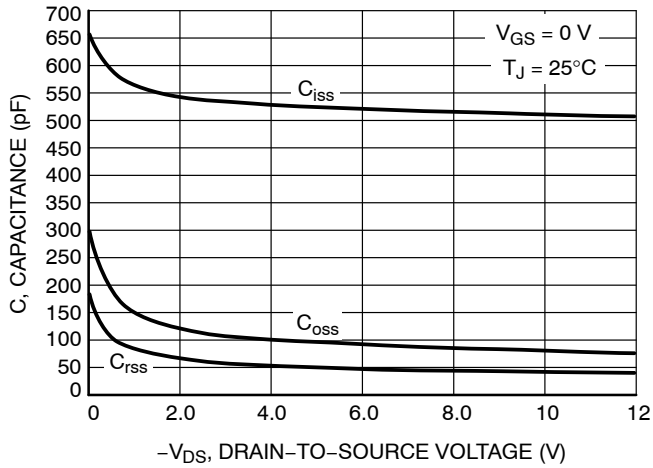


Figure 17. Pch Capacitance Variation

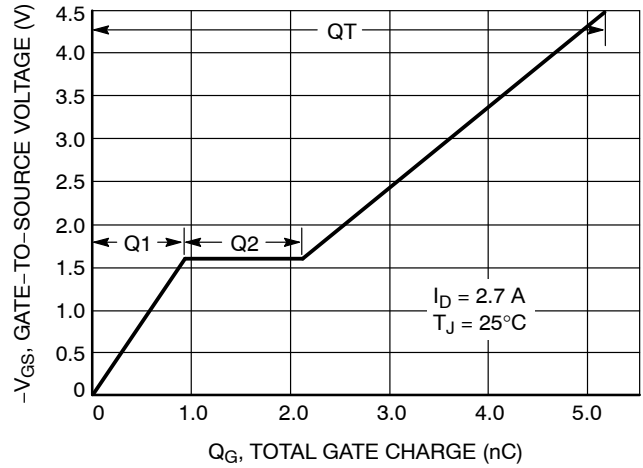


Figure 18. Pch Gate-to-Source Voltage vs. Total Charge

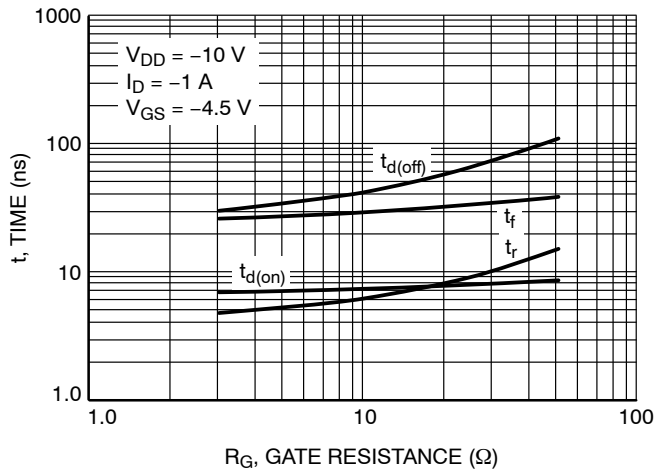


Figure 19. Pch Resistive Switching Time Variation vs. Gate Resistance

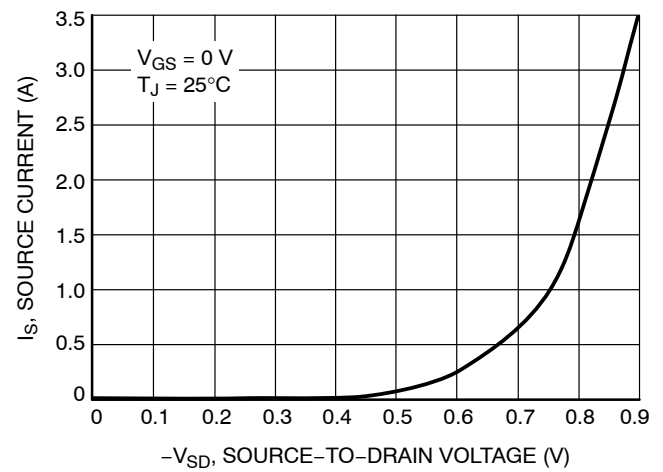
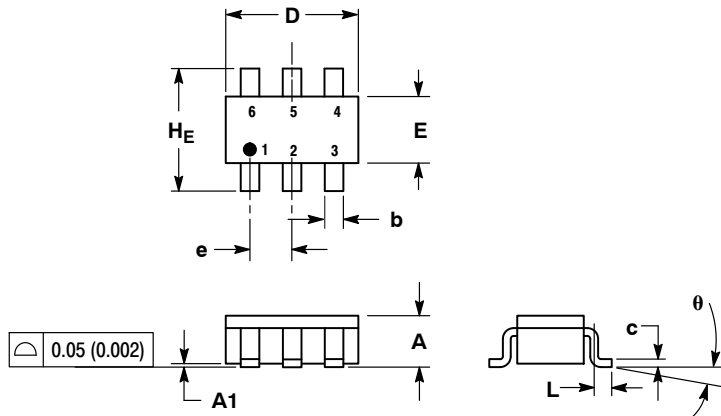


Figure 20. Pch Diode Forward Voltage vs. Current

# NTGD3149C

## PACKAGE DIMENSIONS

TSOP-6  
CASE 318G-02  
ISSUE S



### NOTES:

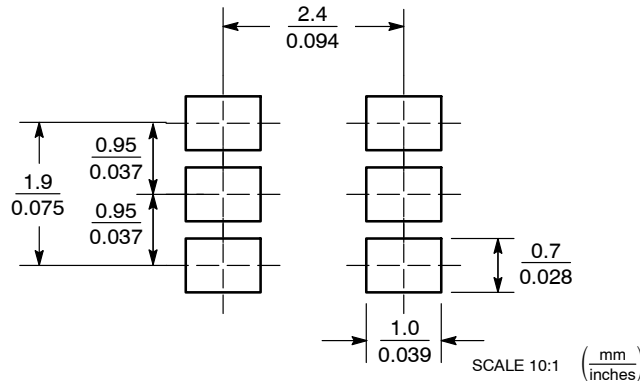
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | MILLIMETERS |      |      | INCHES |       |       |
|-----|-------------|------|------|--------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN    | NOM   | MAX   |
| A   | 0.90        | 1.00 | 1.10 | 0.035  | 0.039 | 0.043 |
| A1  | 0.01        | 0.06 | 0.10 | 0.001  | 0.002 | 0.004 |
| b   | 0.25        | 0.38 | 0.50 | 0.010  | 0.014 | 0.020 |
| c   | 0.10        | 0.18 | 0.26 | 0.004  | 0.007 | 0.010 |
| D   | 2.90        | 3.00 | 3.10 | 0.114  | 0.118 | 0.122 |
| E   | 1.30        | 1.50 | 1.70 | 0.051  | 0.059 | 0.067 |
| e   | 0.85        | 0.95 | 1.05 | 0.034  | 0.037 | 0.041 |
| L   | 0.20        | 0.40 | 0.60 | 0.008  | 0.016 | 0.024 |
| HE  | 2.50        | 2.75 | 3.00 | 0.099  | 0.108 | 0.118 |
| θ   | 0°          | —    | 10°  | 0°     | —     | 10°   |

### STYLE 13:

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