

# NTMFD4902NF

## MOSFET – Power, Dual, N-Channel with Integrated Schottky, SO8FL

30 V, High Side 18 A / Low Side 23 A

### Features

- Co-Packaged Power Stage Solution to Minimize Board Space
- Low Side MOSFET with Integrated Schottky
- Minimized Parasitic Inductances
- Optimized Devices to Reduce Power Losses
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

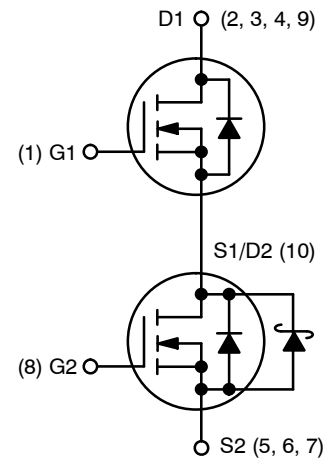
- DC-DC Converters
- System Voltage Rails
- Point of Load



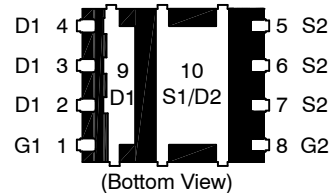
ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

| $V_{(BR)DSS}$         | $R_{DS(ON) MAX}$       | $I_D MAX$ |
|-----------------------|------------------------|-----------|
| Q1 Top FET<br>30 V    | 6.5 m $\Omega$ @ 10 V  | 18 A      |
|                       | 10 m $\Omega$ @ 4.5 V  |           |
| Q2 Bottom FET<br>30 V | 4.1 m $\Omega$ @ 10 V  | 23 A      |
|                       | 6.2 m $\Omega$ @ 4.5 V |           |



### PIN CONNECTIONS



### MARKING DIAGRAM



4902NF = Specific Device Code  
 A = Assembly Location  
 Y = Year  
 W = Work Week  
 ZZ = Lot Traceability

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

# NTMFD4902NF

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

| Parameter  |      |              | Symbol    | Value  | Unit        |                  |    |   |
|--|------|--------------|-----------|--|-------------|------------------|----|---|
| Drain-to-Source Voltage  | Q1   |              | $V_{DSS}$ | 30   | V           |                  |    |   |
| Drain-to-Source Voltage  | Q2   |              |           |  |             |                  |    |   |
| Gate-to-Source Voltage   | Q1   |              | $V_{GS}$  | $\pm 20$   | V           |                  |    |   |
| Gate-to-Source Voltage   | Q2   |              |           |  |             |                  |    |   |
| Continuous Drain Current $R_{\theta JA}$ (Note 1)  |      | Steady State | Q1        | $T_A = 25^\circ\text{C}$                           | 13.5        | A                |    |   |
|  |      |              |           | $T_A = 85^\circ\text{C}$                           | 9.7         |                  |    |   |
|  |      |              | Q2        | $T_A = 25^\circ\text{C}$                           | 17.5        |                  |    |   |
|  |      |              |           | $T_A = 85^\circ\text{C}$                           | 12.6        |                  |    |   |
| Power Dissipation $R_{\theta JA}$ (Note 1)   |      |              | Q1        | $T_A = 25^\circ\text{C}$                           | $P_D$       | 1.90             | W  |   |
|  |      |              |           |  | Q2          | 1.99             |    |   |
| Continuous Drain Current $R_{\theta JA} \leq 10$ s (Note 1)  |      | Steady State | Q1        | $T_A = 25^\circ\text{C}$                           | 18.2        | A                |    |   |
|  |      |              |           | $T_A = 85^\circ\text{C}$                           | 13.1        |                  |    |   |
|  |      |              | Q2        | $T_A = 25^\circ\text{C}$                           | 23          |                  |    |   |
|  |      |              |           | $T_A = 85^\circ\text{C}$                           | 16.6        |                  |    |   |
| Power Dissipation $R_{\theta JA} \leq 10$ s (Note 1)   |      |              | Q1        | $T_A = 25^\circ\text{C}$                           | $P_D$       | 3.45             | W  |   |
|  |      |              |           |  | Q2          | 3.45             |    |   |
| Continuous Drain Current $R_{\theta JA}$ (Note 2)  |      | Steady State | Q1        | $T_A = 25^\circ\text{C}$                           | 10.3        | A                |    |   |
|  |      |              |           | $T_A = 85^\circ\text{C}$                           | 7.4         |                  |    |   |
|  |      |              | Q2        | $T_A = 25^\circ\text{C}$                           | 13.3        |                  |    |   |
|  |      |              |           | $T_A = 85^\circ\text{C}$                           | 9.6         |                  |    |   |
| Power Dissipation $R_{\theta JA}$ (Note 2)   |      |              | Q1        | $T_A = 25^\circ\text{C}$                           | $P_D$       | 1.10             | W  |   |
|  |      |              |           |  | Q2          | 1.16             |    |   |
| Pulsed Drain Current   |      |              |           | $T_A = 25^\circ\text{C}$<br>$t_p = 10 \mu\text{s}$ | Q1          | $I_{DM}$         | 60 | A |
|  |      |              |           |  |             | Q2               | 80 |   |
| Operating Junction and Storage Temperature   |      |              | Q1        | $T_J, T_{STG}$                                     | -55 to +150 | $^\circ\text{C}$ |    |   |
|  |      |              | Q2        |  |             |                  |    |   |
| Source Current (Body Diode)  |      |              | Q1        | $I_S$  | 3.4         | A                |    |   |
|  |      |              | Q2        |  | 4.9         |                  |    |   |
| Drain to Source $dV/dt$  |      |              |           | $dV/dt$  | 6.0         | V/ns             |    |   |
| Single Pulse Drain-to-Source Avalanche Energy ( $T_J = 25^\circ\text{C}$ , $V_{DD} = 50$ V, $V_{GS} = 10$ V, $I_L = XX A_{pk}$ , $L = 0.1$ mH, $R_G = 25 \Omega$ ) | 24 A | Q1           | EAS       | 28.8   | mJ          |                  |    |   |
|  | 27 A | Q2           | EAS       | 36.5   |             |                  |    |   |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s)  |      |              |           | $T_L$  | 260         | $^\circ\text{C}$ |    |   |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Surface-mounted on FR4 board using 1 sq-in pad, 2 oz Cu.

2. Surface-mounted on FR4 board using the minimum recommended pad size of 100 mm<sup>2</sup>.

# NTMFD4902NF

## THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter                                       | FET | Symbol          | Value | Unit |
|---|-----|-----------------|-------|------|
| Junction-to-Ambient – Steady State (Note 3)     | Q1  | $R_{\theta JA}$ | 65.9  | °C/W |
|   | Q2  |                 | 62.8  |      |
| Junction-to-Ambient – Steady State (Note 4)     | Q1  | $R_{\theta JA}$ | 113.2 |      |
|   | Q2  |                 | 108   |      |
| Junction-to-Ambient – ( $t \leq 10$ s) (Note 3) | Q1  | $R_{\theta JA}$ | 36.2  |      |
|   | Q2  |                 | 36.2  |      |

3. Surface-mounted on FR4 board using 1 sq-in pad, 2 oz Cu.

4. Surface-mounted on FR4 board using the minimum recommended pad size of 100 mm<sup>2</sup>.

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

| Parameter  | FET | Symbol              | Test Condition                                  | Min                       | Typ | Max       | Unit          |
|--|-----|---------------------|---|---------------------------|-----|-----------|---------------|
| <b>OFF CHARACTERISTICS</b>                                 |     |                     |   |                           |     |           |               |
| Drain-to-Source Break-down Voltage                         | Q1  | $V_{(BR)DSS}$       | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$   | 30                        |     |           | V             |
|  | Q2  |                     | $V_{GS} = 0\text{ V}, I_D = 1.0\text{ mA}$      | 30                        |     |           |               |
| Drain-to-Source Break-down Voltage Temperature Coefficient | Q1  | $V_{(BR)DSS} / T_J$ |   |                           | 18  |           | mV / °C       |
|  | Q2  |                     |   |                           | 15  |           |               |
| Zero Gate Voltage Drain Current                            | Q1  | $I_{DSS}$           | $V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$     | $T_J = 25^\circ\text{C}$  |     | 1         | $\mu\text{A}$ |
|  |     |                     |   | $T_J = 125^\circ\text{C}$ |     | 10        |               |
|  | Q2  |                     | $V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$     | $T_J = 25^\circ\text{C}$  |     | 500       |               |
|  |     |                     |   |                           |     |           |               |
| Gate-to-Source Leakage Current                             | Q1  | $I_{GSS}$           | $V_{GS} = 0\text{ V}, V_{DS} = \pm 20\text{ V}$ |                           |     | $\pm 100$ | nA            |
|  | Q2  |                     |   |                           |     | $\pm 100$ |               |

## ON CHARACTERISTICS (Note 5)

|  |    |                    |  |     |     |     |         |
|--|----|--------------------|--|-----|-----|-----|---------|
| Gate Threshold Voltage                     | Q1 | $V_{GS(TH)}$       | $V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$  | 1.2 |     | 2.2 | V       |
|  | Q2 |                    |  | 1.2 |     | 2.2 |         |
| Negative Threshold Temperature Coefficient | Q1 | $V_{GS(TH)} / T_J$ |  |     | 4.5 |     | mV / °C |
|  | Q2 |                    |  |     | 4.0 |     |         |
| Drain-to-Source On Resistance              | Q1 | $R_{DS(on)}$       | $V_{GS} = 10\text{ V}, I_D = 10\text{ A}$  |     | 5.2 | 6.5 | mΩ      |
|  |    |                    | $V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$ |     | 8.0 | 10  |         |
|  | Q2 |                    | $V_{GS} = 10\text{ V}, I_D = 15\text{ A}$  |     | 3.3 | 4.1 |         |
|  |    |                    | $V_{GS} = 4.5\text{ V}, I_D = 15\text{ A}$ |     | 5.0 | 6.2 |         |
| Forward Transconductance                   | Q1 | $g_{FS}$           | $V_{DS} = 1.5\text{ V}, I_D = 10\text{ A}$ |     | 28  |     | S       |
|  | Q2 |                    |  |     | 35  |     |         |

## CHARGES, CAPACITANCES & GATE RESISTANCE

|                     |    |           |   |  |      |  |    |
|---------------------|----|-----------|---|--|------|--|----|
| Input Capacitance   | Q1 | $C_{ISS}$ | $V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 15\text{ V}$ |  | 1150 |  | pF |
|                     | Q2 |           |   |  | 1590 |  |    |
| Output Capacitance  | Q1 | $C_{OSS}$ |   |  | 360  |  |    |
|                     | Q2 |           |   |  | 813  |  |    |
| Reverse Capacitance | Q1 | $C_{RSS}$ |   |  | 105  |  |    |
|                     | Q2 |           |   |  | 83   |  |    |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

6. Switching characteristics are independent of operating junction temperatures.

# NTMFD4902NF

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

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

### CHARGES, CAPACITANCES & GATE RESISTANCE

|                       |    |                     |  |   |      |      |    |  |    |
|-----------------------|----|---------------------|--|---|------|------|----|--|----|
| Total Gate Charge     | Q1 | Q <sub>G(TOT)</sub> | V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 15 V; I <sub>D</sub> = 10 A |   | 9.7  |      | nC |  |    |
|                       | Q2 |                     |  |   | 11.5 |      |    |  |    |
| Threshold Gate Charge | Q1 | Q <sub>G(TH)</sub>  |  |   | 1.1  |      |    |  |    |
|                       | Q2 |                     |  |   | 1.4  |      |    |  |    |
| Gate-to-Source Charge | Q1 | Q <sub>GS</sub>     |  |   | 3.3  |      |    |  |    |
|                       | Q2 |                     |  |   | 4.2  |      |    |  |    |
| Gate-to-Drain Charge  | Q1 | Q <sub>GD</sub>     |  |   | 3.7  |      |    |  |    |
|                       | Q2 |                     |  |   | 3.4  |      |    |  |    |
| Total Gate Charge     | Q1 | Q <sub>G(TOT)</sub> |  | V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 15 V; I <sub>D</sub> = 10 A |      | 19.1 |    |  | nC |
|                       | Q2 |                     |  |   |      | 24.9 |    |  |    |

### SWITCHING CHARACTERISTICS (Note 6)

|                     |    |                     |   |  |      |  |    |
|---------------------|----|---------------------|---|--|------|--|----|
| Turn-On Delay Time  | Q1 | t <sub>d(ON)</sub>  | V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 15 V,<br>I <sub>D</sub> = 10 A, R <sub>G</sub> = 3.0 Ω |  | 9.0  |  | ns |
|                     | Q2 |                     |   |  | 10.5 |  |    |
| Rise Time           | Q1 | t <sub>r</sub>      |   |  | 15   |  |    |
|                     | Q2 |                     |   |  | 15.2 |  |    |
| Turn-Off Delay Time | Q1 | t <sub>d(OFF)</sub> |   |  | 14   |  |    |
|                     | Q2 |                     |   |  | 17.7 |  |    |
| Fall Time           | Q1 | t <sub>f</sub>      |   |  | 4.0  |  |    |
|                     | Q2 |                     |   |  | 4.7  |  |    |

### SWITCHING CHARACTERISTICS (Note 6)

|                     |    |                     |  |  |     |  |    |
|---------------------|----|---------------------|--|--|-----|--|----|
| Turn-On Delay Time  | Q1 | t <sub>d(ON)</sub>  | V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 15 V,<br>I <sub>D</sub> = 10 A, R <sub>G</sub> = 3.0 Ω |  | 6.0 |  | ns |
|                     | Q2 |                     |  |  | 7.0 |  |    |
| Rise Time           | Q1 | t <sub>r</sub>      |  |  | 14  |  |    |
|                     | Q2 |                     |  |  | 14  |  |    |
| Turn-Off Delay Time | Q1 | t <sub>d(OFF)</sub> |  |  | 17  |  |    |
|                     | Q2 |                     |  |  | 22  |  |    |
| Fall Time           | Q1 | t <sub>f</sub>      |  |  | 3.0 |  |    |
|                     | Q2 |                     |  |  | 3.3 |  |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                 |    |                 |  |                        |  |      |      |   |
|-----------------|----|-----------------|--|------------------------|--|------|------|---|
| Forward Voltage | Q1 | V <sub>SD</sub> | V <sub>GS</sub> = 0 V,<br>I <sub>S</sub> = 3 A | T <sub>J</sub> = 25°C  |  | 0.75 | 1.0  | V |
|                 |    |                 |  | T <sub>J</sub> = 125°C |  | 0.62 |      |   |
|                 | Q2 |                 | V <sub>GS</sub> = 0 V,<br>I <sub>S</sub> = 2 A | T <sub>J</sub> = 25°C  |  | 0.37 | 0.70 |   |
|                 |    |                 |  | T <sub>J</sub> = 125°C |  | 0.31 |      |   |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

6. Switching characteristics are independent of operating junction temperatures.

# NTMFD4902NF

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

| Parameter                                 | FET | Symbol          | Test Condition  | Min | Typ  | Max | Unit |
|---|-----|-----------------|---|-----|------|-----|------|
| <b>DRAIN-SOURCE DIODE CHARACTERISTICS</b> |     |                 |   |     |      |     |      |
| Reverse Recovery Time                     | Q1  | t <sub>RR</sub> | V <sub>GS</sub> = 0 V, d <sub>IS</sub> /d <sub>t</sub> = 100 A/μs, I <sub>S</sub> = 3 A |     | 23   |     | ns   |
|   | Q2  |                 |   |     | 24.5 |     |      |
| Charge Time                               | Q1  | t <sub>a</sub>  |   |     | 12   |     |      |
|   | Q2  |                 |   |     | 13   |     |      |
| Discharge Time                            | Q1  | t <sub>b</sub>  |   |     | 11   |     |      |
|   | Q2  |                 |   |     | 11.5 |     |      |
| Reverse Recovery Charge                   | Q1  | Q <sub>RR</sub> |   |     | 12   |     | nC   |
|   | Q2  |                 |   |     | 24   |     |      |

## PACKAGE PARASITIC VALUES

|                   |    |                |                       |  |       |  |    |
|-------------------|----|----------------|-----------------------|--|-------|--|----|
| Source Inductance | Q1 | L <sub>S</sub> | T <sub>A</sub> = 25°C |  | 0.38  |  | nH |
|                   | Q2 |                |                       |  | 0.65  |  |    |
| Drain Inductance  | Q1 | L <sub>D</sub> |                       |  | 0.054 |  | nH |
|                   | Q2 |                |                       |  | 0.007 |  |    |
| Gate Inductance   | Q1 | L <sub>G</sub> |                       |  | 1.5   |  | nH |
|                   | Q2 |                |                       |  | 1.5   |  |    |
| Gate Resistance   | Q1 | R <sub>G</sub> |                       |  | 0.8   |  | Ω  |
|                   | Q2 |                |                       |  | 0.8   |  |    |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

6. Switching characteristics are independent of operating junction temperatures.

## ORDERING INFORMATION

| Device         | Package           | Shipping <sup>†</sup> |
|----------------|-------------------|-----------------------|
| NTMFD4902NFT1G | DFN8<br>(Pb-Free) | 1500 / Tape & Reel    |
| NTMFD4902NFT3G | DFN8<br>(Pb-Free) | 5000 / 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 – Q1

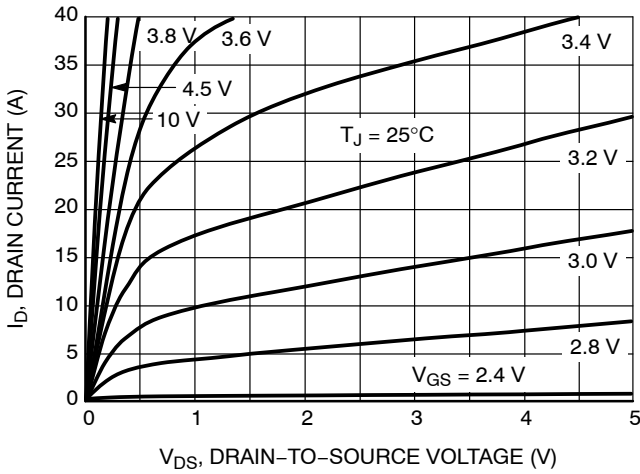


Figure 1. On-Region Characteristics

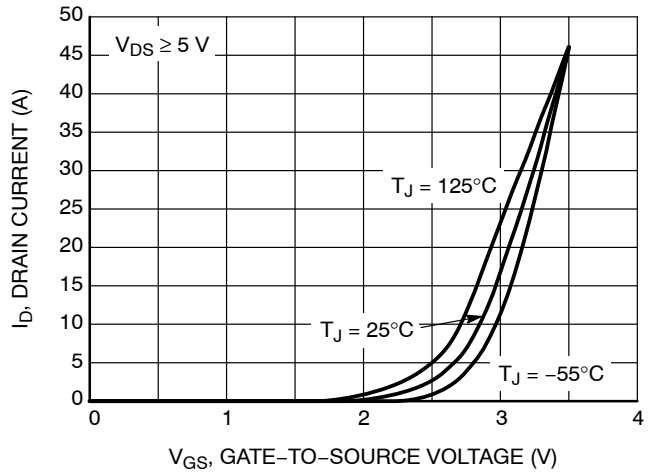


Figure 2. Transfer Characteristics

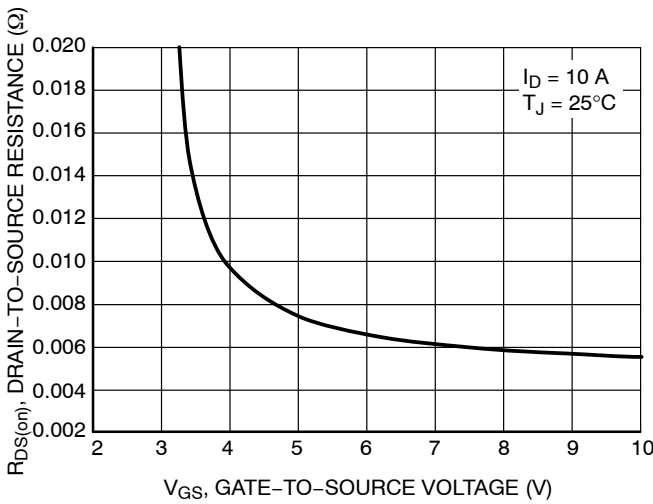


Figure 3. On-Resistance vs. Gate-to-Source Resistance

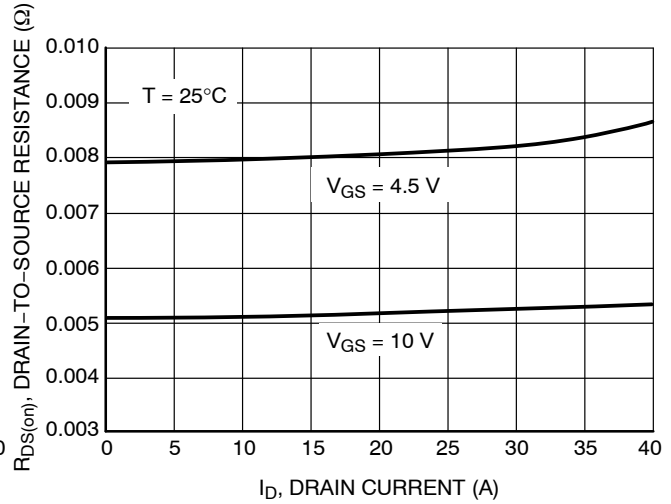


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

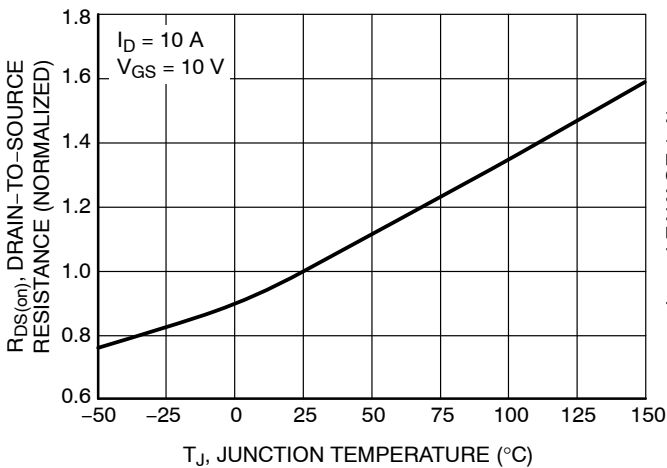


Figure 5. On-Resistance Variation with Temperature

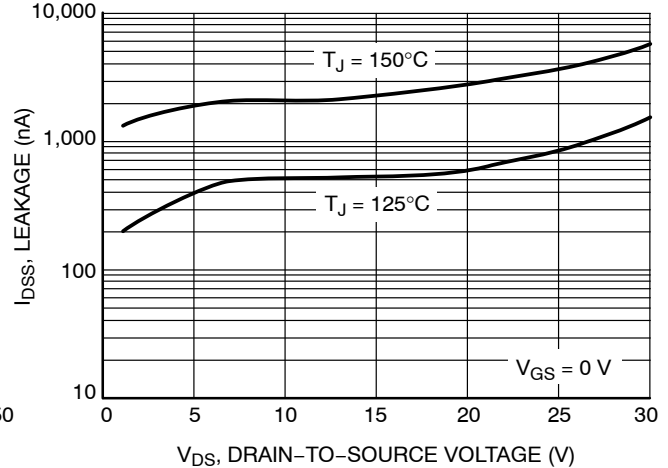
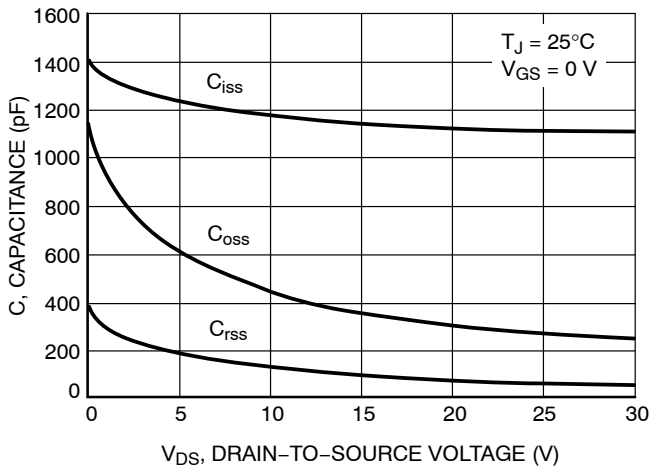


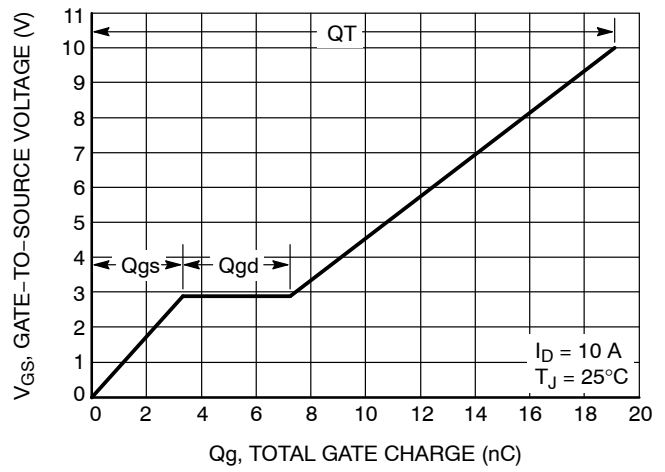
Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTMFD4902NF

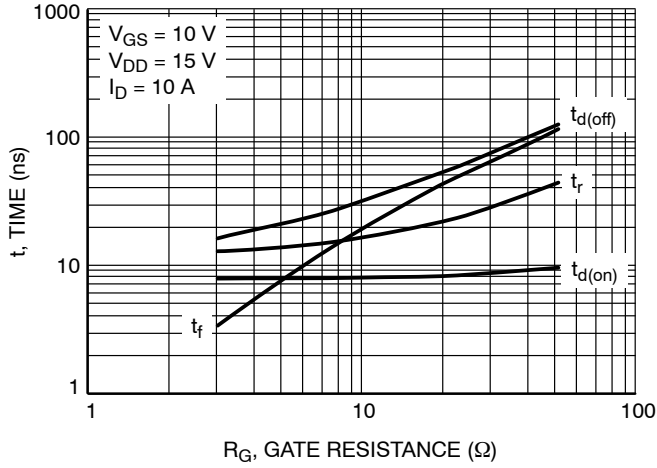
## TYPICAL CHARACTERISTICS – Q1



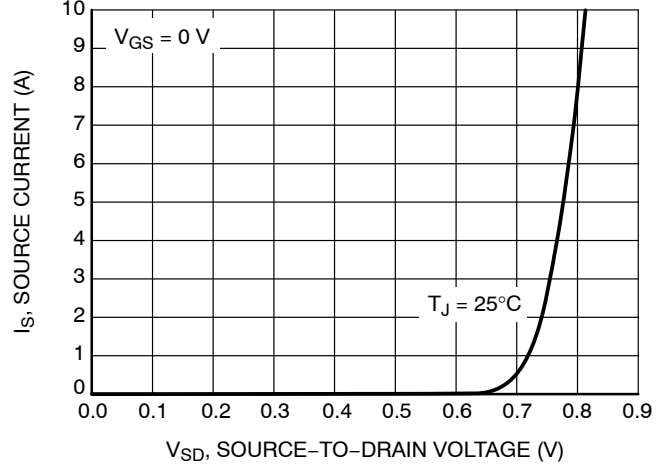
**Figure 7. Capacitance Variation**



**Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



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



**Figure 10. Diode Forward Voltage vs. Current**

TYPICAL CHARACTERISTICS – Q2

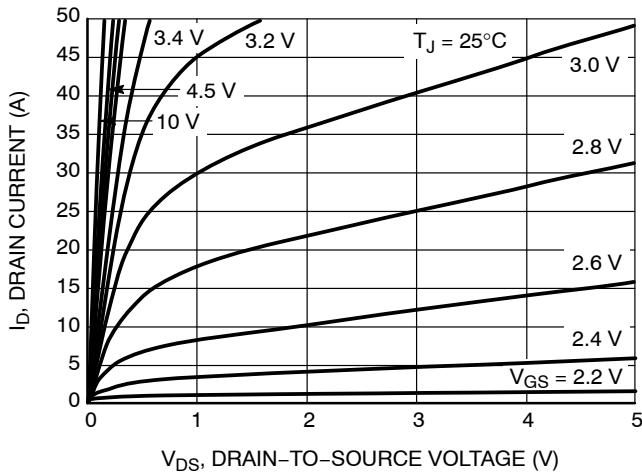


Figure 11. On-Region Characteristics

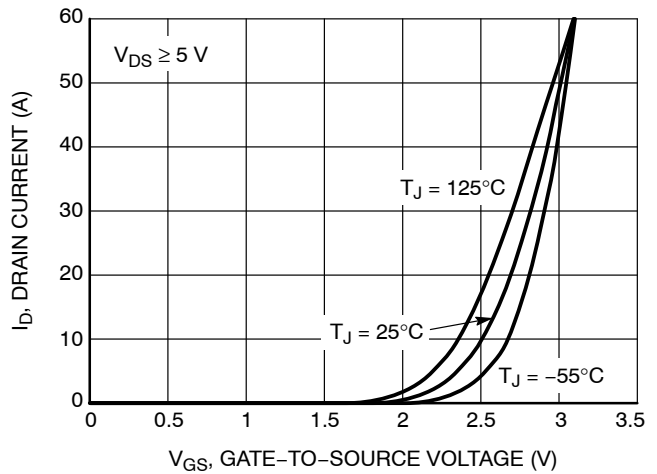


Figure 12. Transfer Characteristics

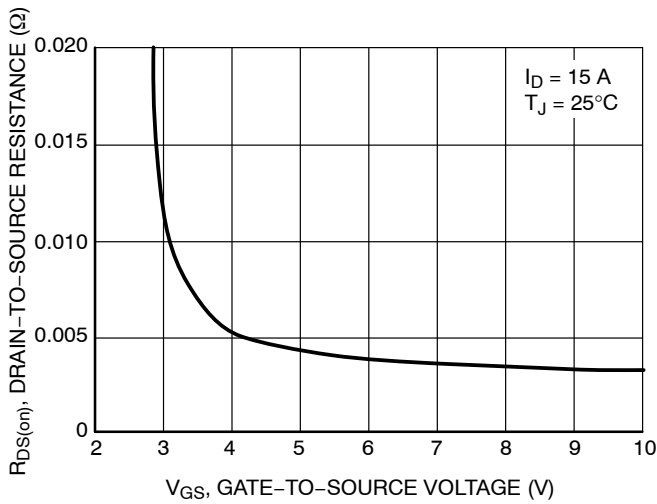


Figure 13. On-Resistance vs. Gate-to-Source Resistance

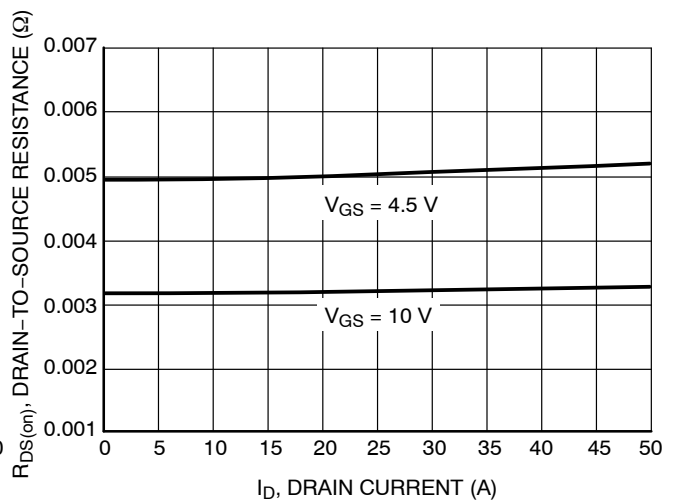


Figure 14. On-Resistance vs. Drain Current and Gate Voltage

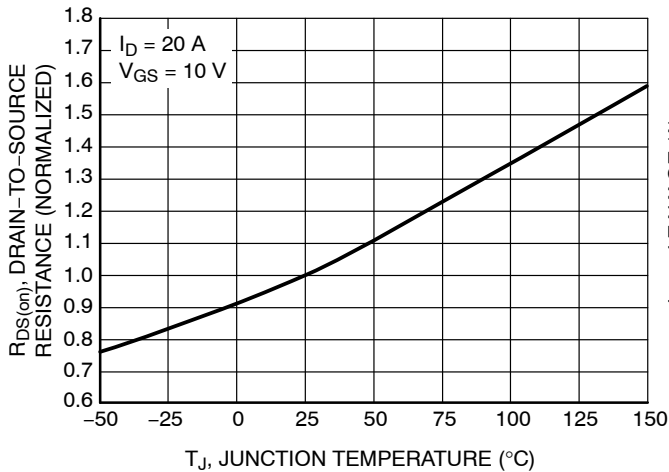


Figure 15. On-Resistance Variation with Temperature

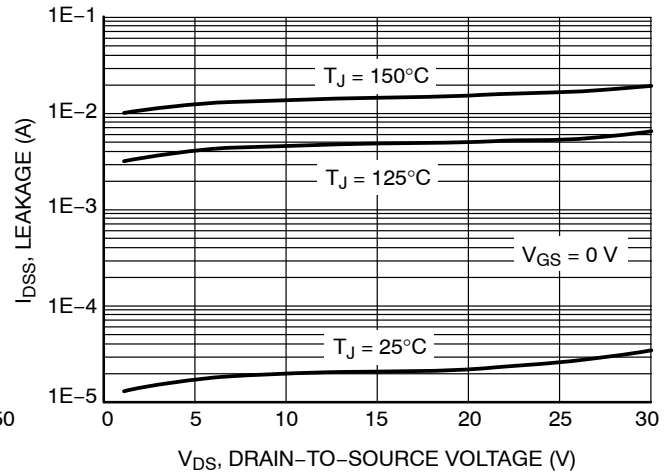
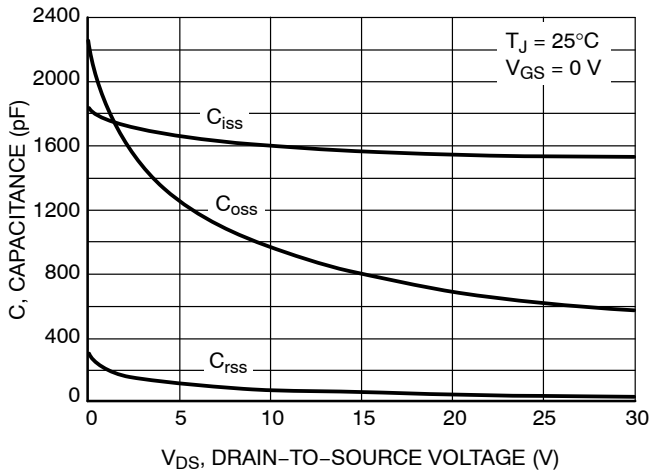


Figure 16. Drain-to-Source Leakage Current vs. Voltage

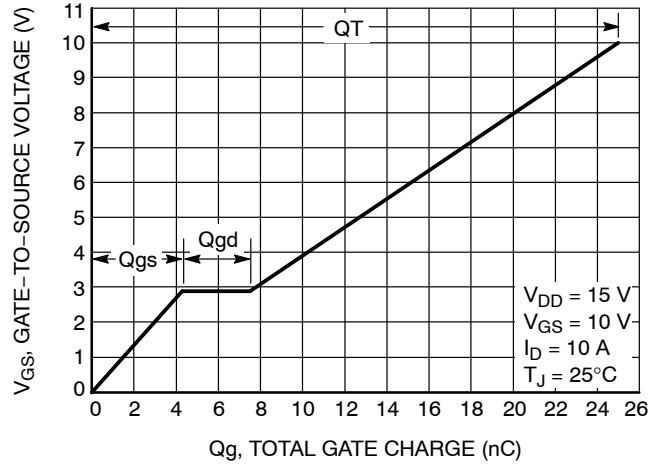


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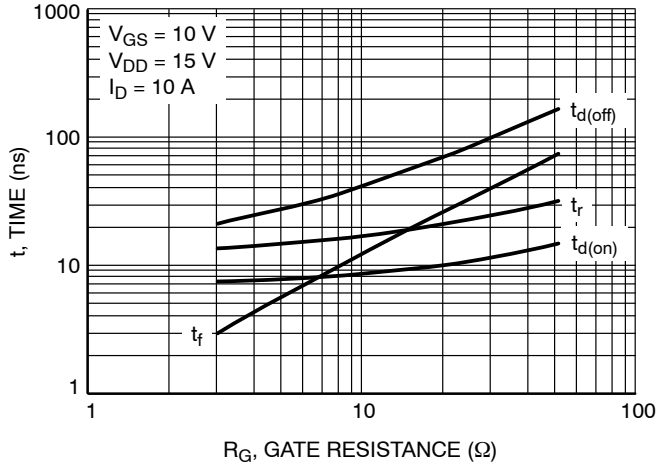
## TYPICAL CHARACTERISTICS – Q2



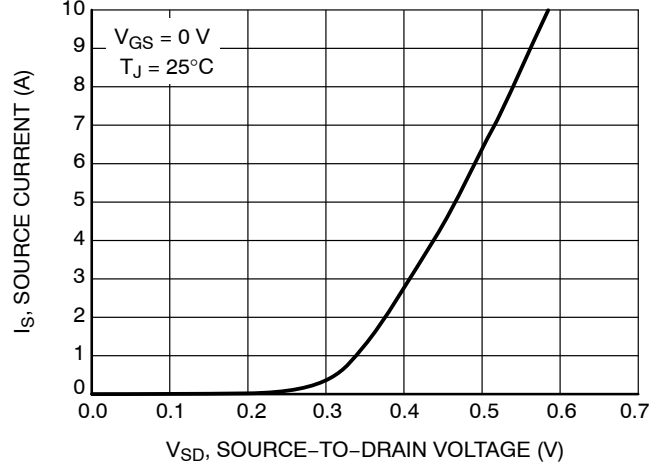
**Figure 17. Capacitance Variation**



**Figure 18. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



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



**Figure 20. Diode Forward Voltage vs. Current**



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