

# NTMFD4901NF

## Dual N-Channel Power MOSFET with Integrated Schottky

30 V, High Side 18 A / Low Side 30 A, Dual N-Channel SO8FL

### 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

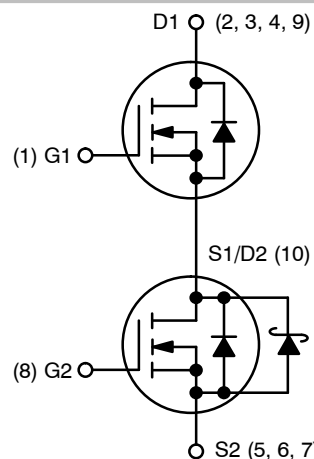
- DC-DC Converters
- System Voltage Rails
- Point of Load



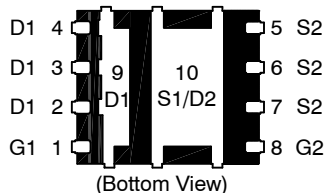
ON Semiconductor®

<http://onsemi.com>

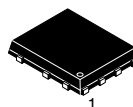
| $V_{(BR)DSS}$         | $R_{DS(ON) MAX}$ | $I_D MAX$ |
|-----------------------|------------------|-----------|
| Q1 Top FET<br>30 V    | 6.5 mΩ @ 10 V    | 18 A      |
|                       | 10 mΩ @ 4.5 V    |           |
| Q2 Bottom FET<br>30 V | 2.35 mΩ @ 10 V   | 30 A      |
|                       | 3.5 mΩ @ 4.5 V   |           |



### PIN CONNECTIONS



### MARKING DIAGRAM



DFN8  
CASE 506BX



4901NF = 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.

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

| Parameter   |              |                  | Symbol   | Value       | Unit |
|---|--------------|------------------|--|-------------|------|
| Drain-to-Source Voltage   | Q1           | V <sub>DSS</sub> | 30   | V           |      |
| Drain-to-Source Voltage   | Q2           |                  |  |             |      |
| Gate-to-Source Voltage  | Q1           | V <sub>GS</sub>  | ±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               | $T_A = 25^\circ\text{C}$                           | 23.4        |      |
|   |              |                  | $T_A = 85^\circ\text{C}$                           | 16.9        |      |
| Power Dissipation $R_{\theta JA}$ (Note 1)  | Steady State | Q1               | $T_A = 25^\circ\text{C}$                           | 1.90        | W    |
|   |              |                  |  | Q2          |      |
| Continuous Drain Current $R_{\theta JA} \leq 10$ s (Note 1)   | Steady State | Q1               | $T_A = 25^\circ\text{C}$                           | 18.2        | A    |
|   |              |                  |  | Q2          |      |
|   |              | Q1               | $T_A = 25^\circ\text{C}$                           |             |      |
|   |              |                  |  | Q2          |      |
| Power Dissipation $R_{\theta JA} \leq 10$ s (Note 1)  | Steady State | Q1               | $T_A = 25^\circ\text{C}$                           |             | 3.45 |
|   |              |                  |  | Q2          | 3.45 |
| Continuous Drain Current $R_{\theta JA}$ (Note 2)   | Steady State | Q1               | $T_A = 25^\circ\text{C}$                           | 10.3        | A    |
|   |              |                  |  | Q2          |      |
|   |              | Q1               | $T_A = 25^\circ\text{C}$                           |             |      |
|   |              |                  |  | Q2          |      |
| Power Dissipation $R_{\theta JA}$ (Note 2)  | Steady State | Q1               | $T_A = 25^\circ\text{C}$                           |             | 1.10 |
|   |              |                  |  | Q2          | 1.20 |
| Pulsed Drain Current  | Steady State | Q1               | $T_A = 25^\circ\text{C}$<br>$t_p = 10 \mu\text{s}$ | 60          | A    |
|   |              |                  |  | Q2          |      |
| Operating Junction and Storage Temperature  | Steady State | Q1               | $T_J, T_{STG}$                                     | -55 to +150 | °C   |
|   |              | Q2               |  |             |      |
| Source Current (Body Diode)   | Steady State | Q1               | I <sub>S</sub>                                     | 3.4         | A    |
|   |              | Q2               |  | 4.9         |      |
| Drain to Source DV/DT   |              |                  | dV/dt  | 6           | 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 <sub>pk</sub> , $L = 0.1$ mH, $R_G = 25 \Omega$ ) | Steady State | Q1               | EAS  | 28.8        | mJ   |
|   |              | Q2               | EAS  | 115         |      |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s)   |              |                  | T <sub>L</sub>                                     | 260         | °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.

- Surface-mounted on FR4 board using 1 sq-in pad, 2 oz Cu.
- Surface-mounted on FR4 board using the minimum recommended pad size of 100 mm<sup>2</sup>.

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## THEMAL RESISTANCE MAXIMUM RATINGS

| Parameter                                       | FET | Symbol          | Value | Unit |
|---|-----|-----------------|-------|------|
| Junction-to-Ambient – Steady State (Note 3)     | Q1  | $R_{\theta JA}$ | 65.9  | °C/W |
|   | Q2  |                 | 60.5  |      |
| Junction-to-Ambient – Steady State (Note 4)     | Q1  | $R_{\theta JA}$ | 113.2 |      |
|   | Q2  |                 | 104   |      |
| 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  | $V_{(BR)DSS}$       | $V_{GS} = 0$ V, $I_D = 250$ $\mu$ A | 30                        |     |           | V       |
|  | Q2  |                     | $V_{GS} = 0$ V, $I_D = 1$ 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  | $I_{DSS}$           | $V_{GS} = 0$ V, $V_{DS} = 24$ V     | $T_J = 25^\circ\text{C}$  |     | 1         | $\mu$ A |
|  |     |                     |                                     | $T_J = 125^\circ\text{C}$ |     | 10        |         |
|  | Q2  |                     | $V_{GS} = 0$ V, $V_{DS} = 24$ V     | $T_J = 25^\circ\text{C}$  |     | 500       |         |
|  |     |                     |                                     |                           |     |           |         |
| Gate-to-Source Leakage Current                             | Q1  | $I_{GSS}$           | $V_{GS} = 0$ V, $V_{DS} = \pm 20$ V |                           |     | $\pm 100$ | nA      |
|  | Q2  |                     |                                     |                           |     | $\pm 100$ |         |

## ON CHARACTERISTICS (Note 5)

|  |    |                    |   |              |     |     |         |            |
|--|----|--------------------|---|--------------|-----|-----|---------|------------|
| Gate Threshold Voltage                     | Q1 | $V_{GS(TH)}$       | $V_{GS} = V_{DS}$ , $I_D = 250$ $\mu$ 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 | $R_{DS(on)}$       | $V_{GS} = 10$ V                         | $I_D = 10$ A |     | 5.2 | 6.5     | m $\Omega$ |
|  |    |                    | $V_{GS} = 4.5$ V                        | $I_D = 10$ A |     | 8.0 | 10      |            |
|  | Q2 |                    | $V_{GS} = 10$ V                         | $I_D = 20$ A |     | 1.9 | 2.35    |            |
|  |    |                    | $V_{GS} = 4.5$ V                        | $I_D = 20$ A |     | 2.8 | 3.5     |            |
| Forward Transconductance                   | Q1 | $g_{FS}$           | $V_{DS} = 1.5$ V, $I_D = 10$ A          |              | 28  |     | S       |            |
|  | Q2 |                    |   |              | 45  |     |         |            |

## CHARGES, CAPACITANCES & GATE RESISTANCE

|                     |    |           |  |  |      |  |    |
|---------------------|----|-----------|--|--|------|--|----|
| Input Capacitance   | Q1 | $C_{ISS}$ | $V_{GS} = 0$ V, $f = 1$ MHz, $V_{DS} = 15$ V |  | 1150 |  | pF |
|                     | Q2 |           |  |  | 2950 |  |    |
| Output Capacitance  | Q1 | $C_{OSS}$ |  |  | 360  |  |    |
|                     | Q2 |           |  |  | 1100 |  |    |
| Reverse Capacitance | Q1 | $C_{RSS}$ |  |  | 105  |  |    |
|                     | Q2 |           |  |  | 82   |  |    |

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

6. Switching characteristics are independent of operating junction temperatures.

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

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

### CHARGES, CAPACITANCES & GATE RESISTANCE

|                       |    |              |  |   |     |      |    |  |    |
|-----------------------|----|--------------|--|---|-----|------|----|--|----|
| Total Gate Charge     | Q1 | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 10\text{ A}$ |   | 9.7 |      | nC |  |    |
|                       | Q2 |              |  |   | 20  |      |    |  |    |
| Threshold Gate Charge | Q1 | $Q_{G(TH)}$  |  |   | 1.1 |      |    |  |    |
|                       | Q2 |              |  |   | 2.7 |      |    |  |    |
| Gate-to-Source Charge | Q1 | $Q_{GS}$     |  |   | 3.3 |      |    |  |    |
|                       | Q2 |              |  |   | 7.3 |      |    |  |    |
| Gate-to-Drain Charge  | Q1 | $Q_{GD}$     |  |   | 3.7 |      |    |  |    |
|                       | Q2 |              |  |   | 5.3 |      |    |  |    |
| Total Gate Charge     | Q1 | $Q_{G(TOT)}$ |  | $V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}; I_D = 10\text{ A}$ |     | 19.1 |    |  | nC |
|                       | Q2 |              |  |   |     | 42.7 |    |  |    |

### SWITCHING CHARACTERISTICS (Note 6)

|                     |    |              |  |  |     |  |    |
|---------------------|----|--------------|--|--|-----|--|----|
| Turn-On Delay Time  | Q1 | $t_{d(ON)}$  | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V},$<br>$I_D = 10\text{ A}, R_G = 3.0\ \Omega$ |  | 9.0 |  | ns |
|                     | Q2 |              |  |  | 14  |  |    |
| Rise Time           | Q1 | $t_r$        |  |  | 15  |  |    |
|                     | Q2 |              |  |  | 16  |  |    |
| Turn-Off Delay Time | Q1 | $t_{d(OFF)}$ |  |  | 14  |  |    |
|                     | Q2 |              |  |  | 25  |  |    |
| Fall Time           | Q1 | $t_f$        |  |  | 4.0 |  |    |
|                     | Q2 |              |  |  | 7.0 |  |    |

### SWITCHING CHARACTERISTICS (Note 6)

|                     |    |              |   |  |     |  |    |
|---------------------|----|--------------|---|--|-----|--|----|
| Turn-On Delay Time  | Q1 | $t_{d(ON)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V},$<br>$I_D = 10\text{ A}, R_G = 3.0\ \Omega$ |  | 6.0 |  | ns |
|                     | Q2 |              |   |  | 10  |  |    |
| Rise Time           | Q1 | $t_r$        |   |  | 14  |  |    |
|                     | Q2 |              |   |  | 15  |  |    |
| Turn-Off Delay Time | Q1 | $t_{d(OFF)}$ |   |  | 17  |  |    |
|                     | Q2 |              |   |  | 32  |  |    |
| Fall Time           | Q1 | $t_f$        |   |  | 3.0 |  |    |
|                     | Q2 |              |   |  | 5.0 |  |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                 |    |          |  |                           |      |      |   |
|-----------------|----|----------|--|---------------------------|------|------|---|
| Forward Voltage | Q1 | $V_{SD}$ | $V_{GS} = 0\text{ V},$<br>$I_S = 3\text{ A}$ | $T_J = 25^\circ\text{C}$  | 0.75 | 1.0  | V |
|                 |    |          |  | $T_J = 125^\circ\text{C}$ | 0.62 |      |   |
|                 | Q2 |          | $V_{GS} = 0\text{ V},$<br>$I_S = 2\text{ A}$ | $T_J = 25^\circ\text{C}$  | 0.45 | 0.70 |   |
|                 |    |          |  | $T_J = 125^\circ\text{C}$ | 0.37 |      |   |

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

6. Switching characteristics are independent of operating junction temperatures.

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

| Parameter                                 | FET | Symbol   | Test Condition   | Min | Typ | Max | Unit |
|---|-----|----------|--|-----|-----|-----|------|
| <b>DRAIN-SOURCE DIODE CHARACTERISTICS</b> |     |          |  |     |     |     |      |
| Reverse Recovery Time                     | Q1  | $t_{RR}$ | $V_{GS} = 0\text{ V}, d_{IS}/d_t = 100\text{ A}/\mu\text{s}, I_S = 3\text{ A}$ |     | 23  |     | ns   |
|   | Q2  |          |  |     | 40  |     |      |
| Charge Time                               | Q1  | $t_a$    |  |     | 12  |     |      |
|   | Q2  |          |  |     | 21  |     |      |
| Discharge Time                            | Q1  | $t_b$    |  |     | 11  |     |      |
|   | Q2  |          |  |     | 19  |     |      |
| Reverse Recovery Charge                   | Q1  | $Q_{RR}$ |  |     | 12  |     | nC   |
|   | Q2  |          |  |     | 40  |     |      |

## PACKAGE PARASITIC VALUES

|                   |    |       |                          |  |       |  |          |
|-------------------|----|-------|--------------------------|--|-------|--|----------|
| Source Inductance | Q1 | $L_S$ | $T_A = 25^\circ\text{C}$ |  | 0.38  |  | nH       |
|                   | Q2 |       |                          |  | 0.65  |  |          |
| Drain Inductance  | Q1 | $L_D$ |                          |  | 0.054 |  | nH       |
|                   | Q2 |       |                          |  | 0.007 |  |          |
| Gate Inductance   | Q1 | $L_G$ |                          |  | 1.5   |  | nH       |
|                   | Q2 |       |                          |  | 1.5   |  |          |
| Gate Resistance   | Q1 | $R_G$ |                          |  | 0.8   |  | $\Omega$ |
|                   | Q2 |       |                          |  | 0.8   |  |          |

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

6. Switching characteristics are independent of operating junction temperatures.

## ORDERING INFORMATION

| Device         | Package           | Shipping <sup>†</sup> |
|----------------|-------------------|-----------------------|
| NTMFD4901NFT1G | DFN8<br>(Pb-Free) | 1500 / 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.

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## TYPICAL CHARACTERISTICS – Q1

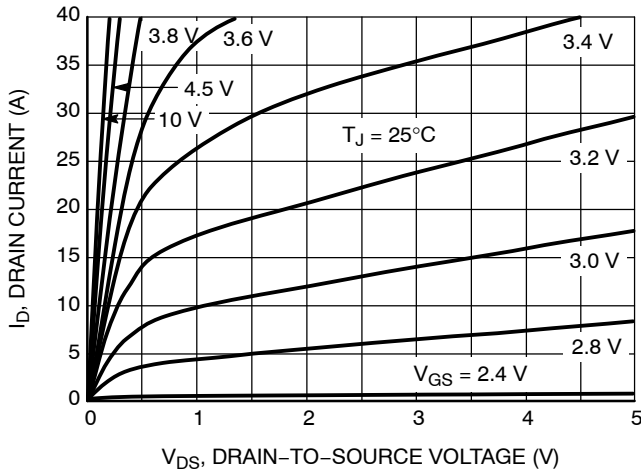


Figure 1. On-Region Characteristics

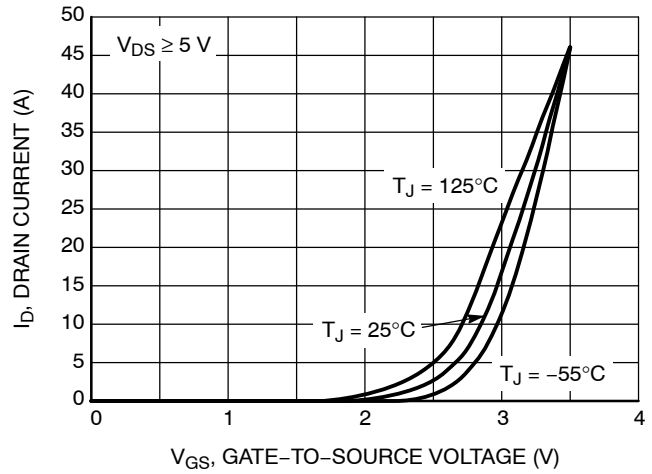


Figure 2. Transfer Characteristics

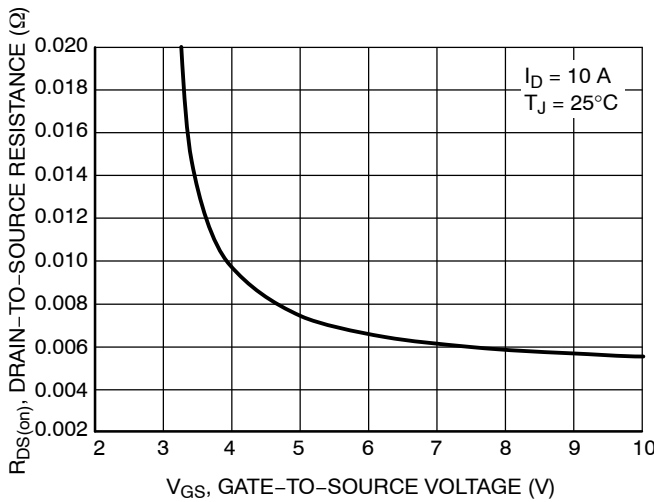


Figure 3. On-Resistance vs. Gate-to-Source Resistance

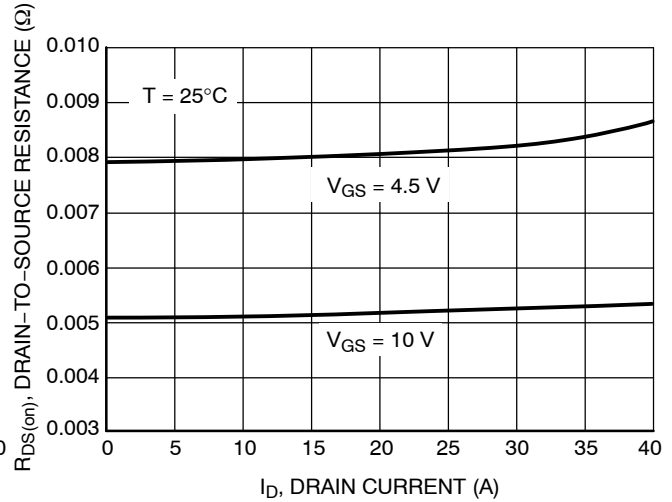


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

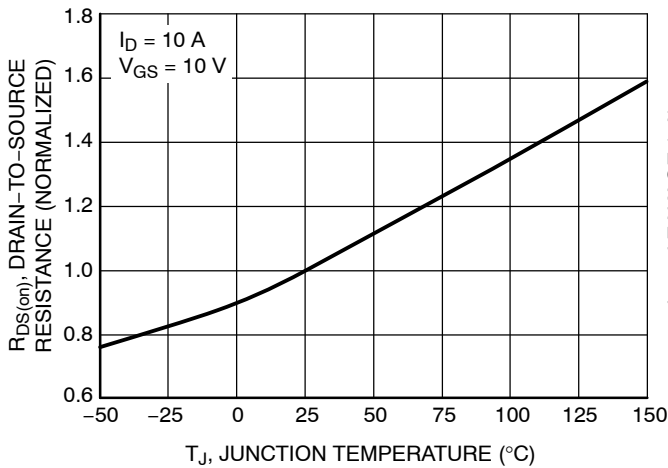


Figure 5. On-Resistance Variation with Temperature

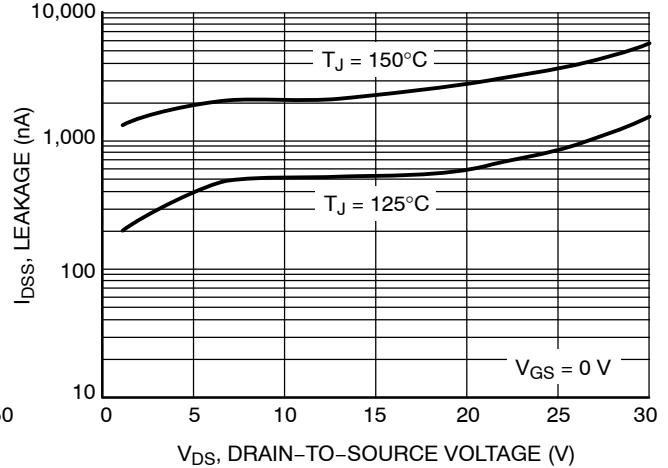


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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## TYPICAL CHARACTERISTICS – Q1

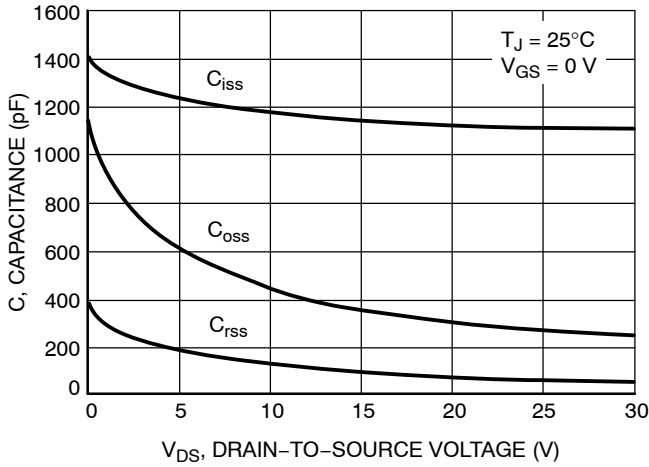


Figure 7. Capacitance Variation

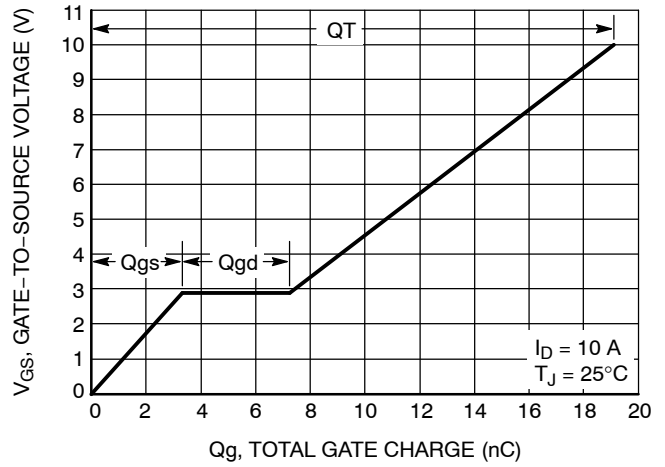


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

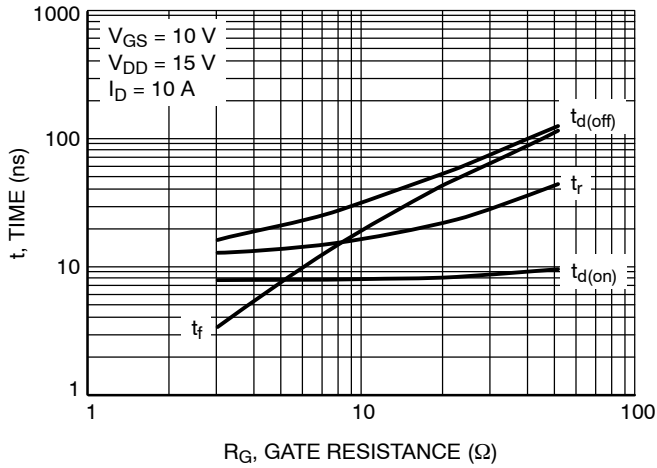


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

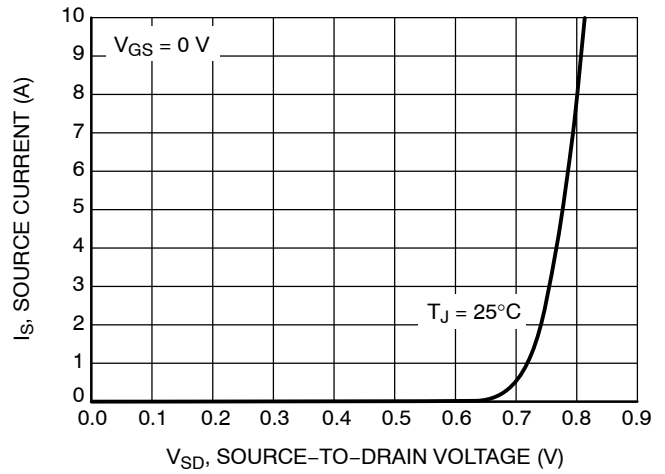


Figure 10. Diode Forward Voltage vs. Current

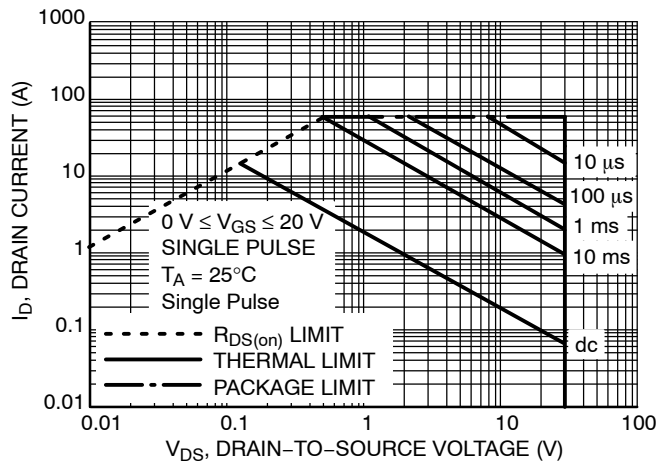


Figure 11. Maximum Rated Forward Biased Safe Operating Area

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## TYPICAL CHARACTERISTICS – Q1

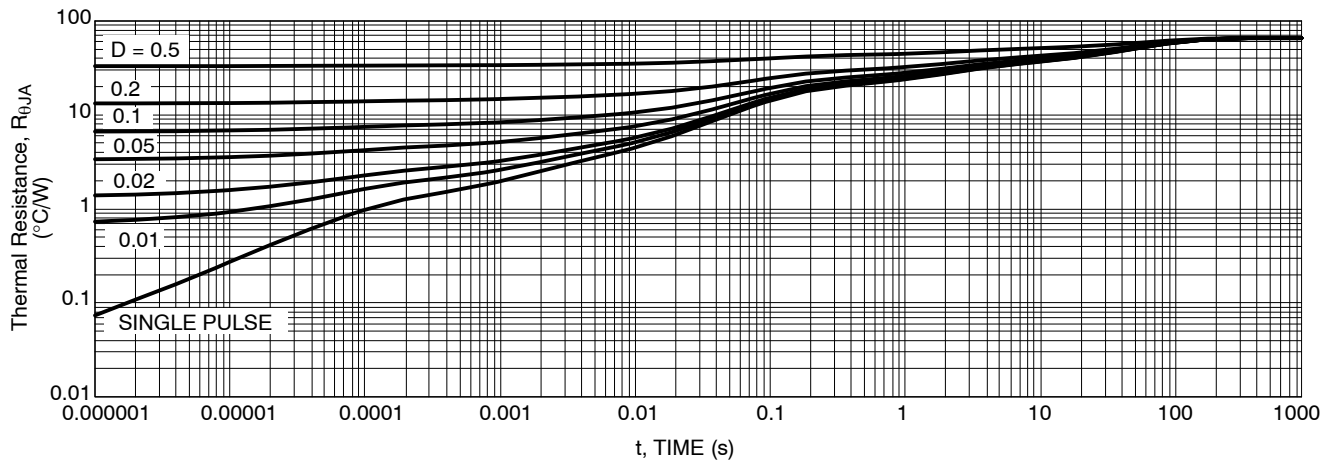


Figure 12. Thermal Response



TYPICAL CHARACTERISTICS – Q2

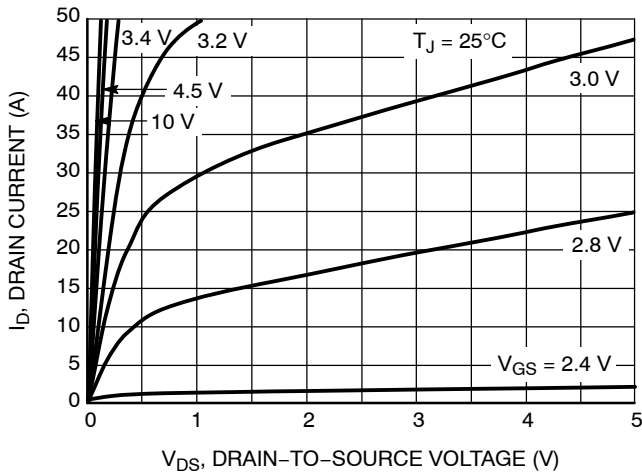


Figure 13. On-Region Characteristics

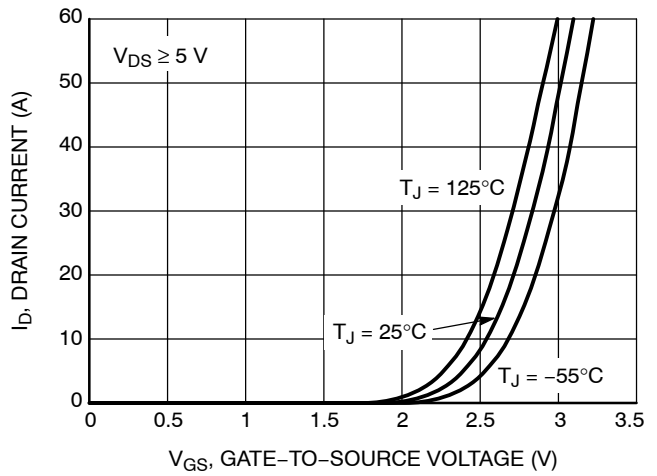


Figure 14. Transfer Characteristics

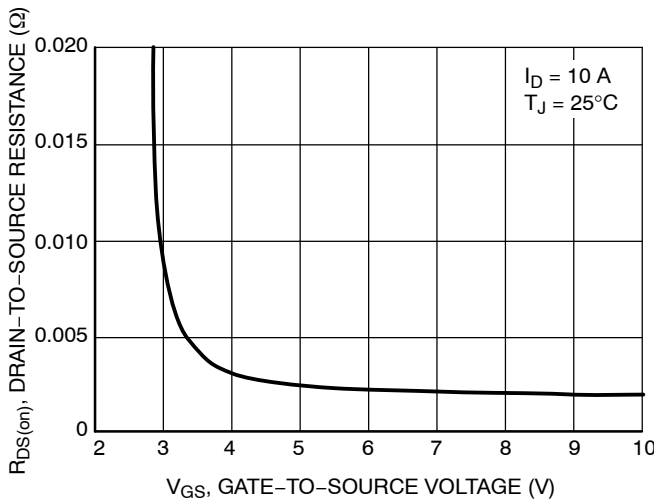


Figure 15. On-Resistance vs. Gate-to-Source Resistance

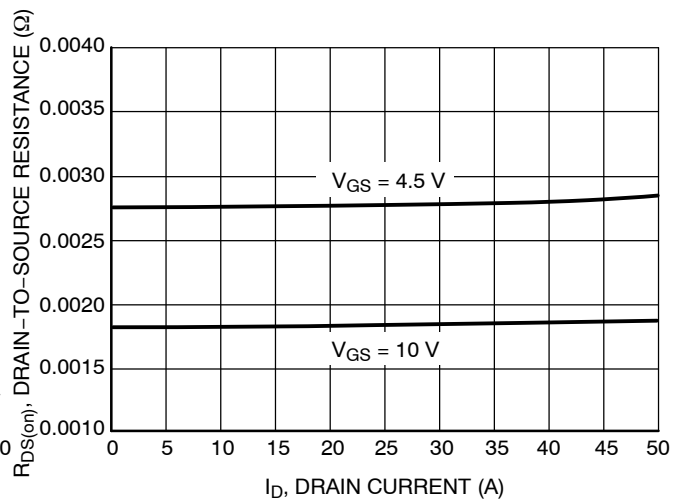


Figure 16. On-Resistance vs. Drain Current and Gate Voltage

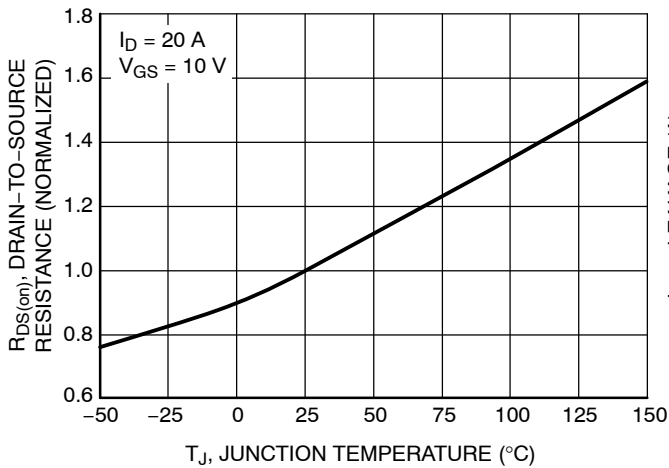


Figure 17. On-Resistance Variation with Temperature

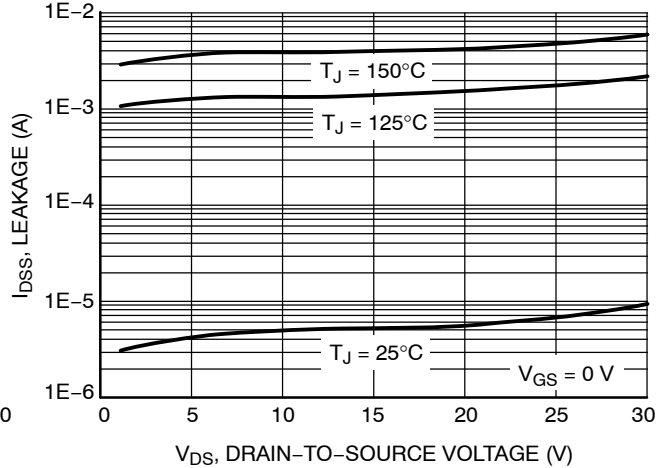
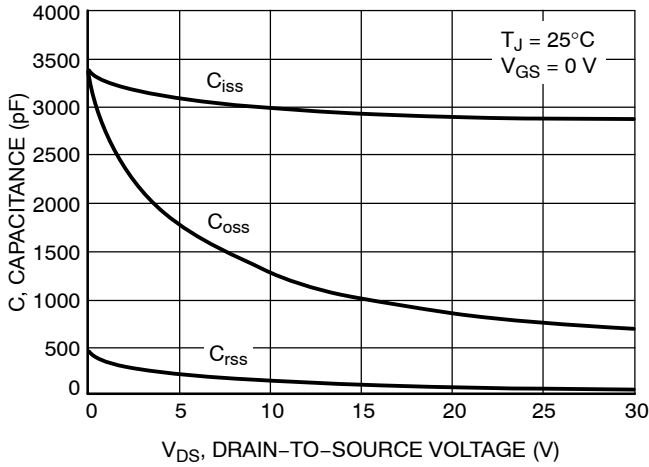


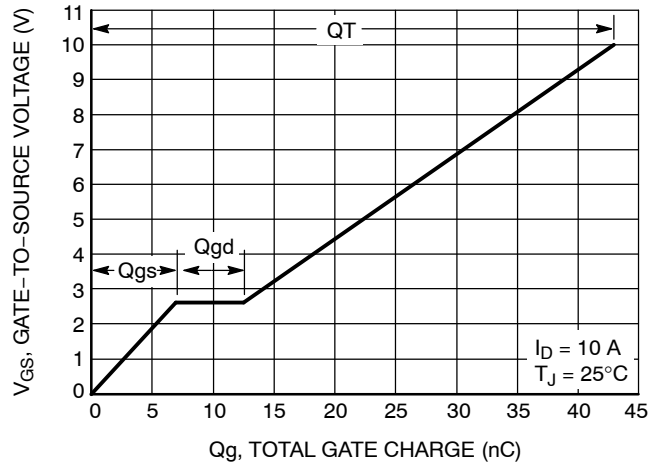
Figure 18. Drain-to-Source Leakage Current vs. Voltage

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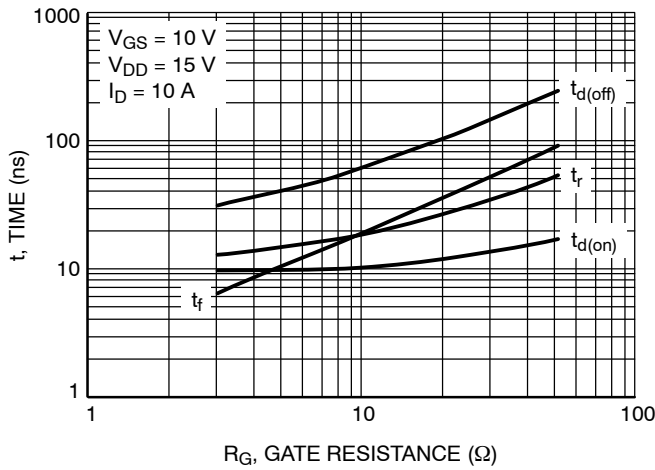
## TYPICAL CHARACTERISTICS – Q2



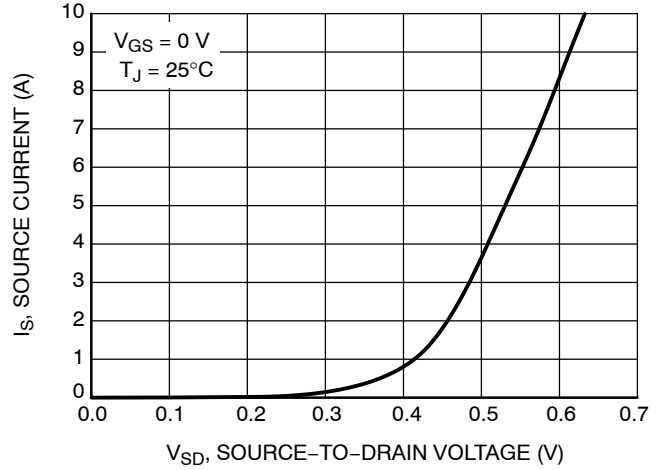
**Figure 19. Capacitance Variation**



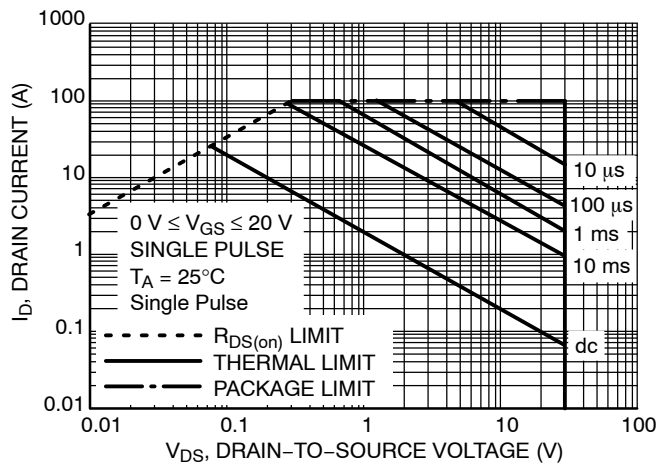
**Figure 20. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



**Figure 21. Resistive Switching Time Variation vs. Gate Resistance**



**Figure 22. Diode Forward Voltage vs. Current**



**Figure 23. Maximum Rated Forward Biased Safe Operating Area**

# NTMFD4901NF

## TYPICAL CHARACTERISTICS – Q2

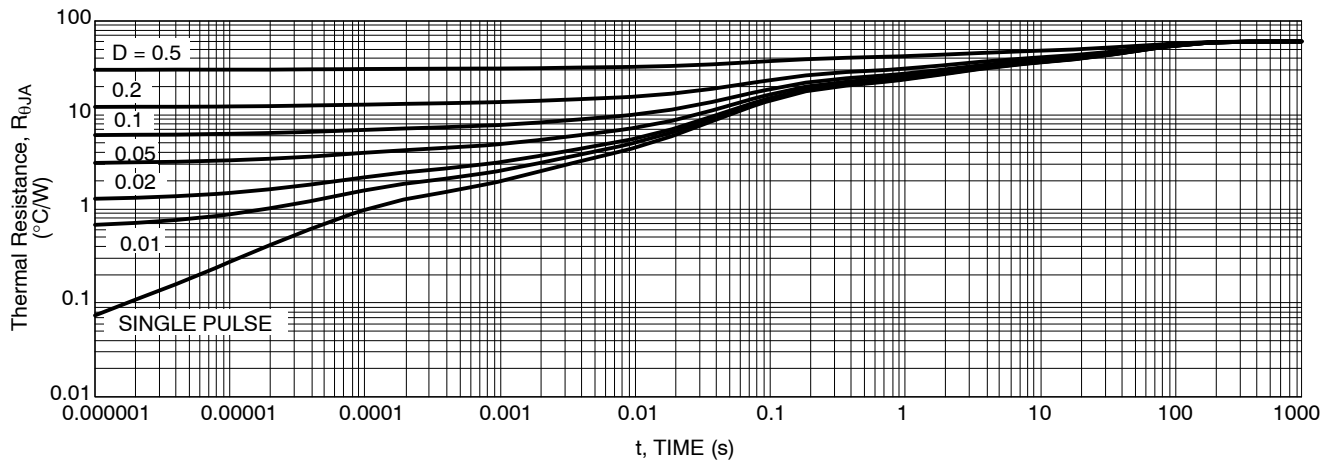
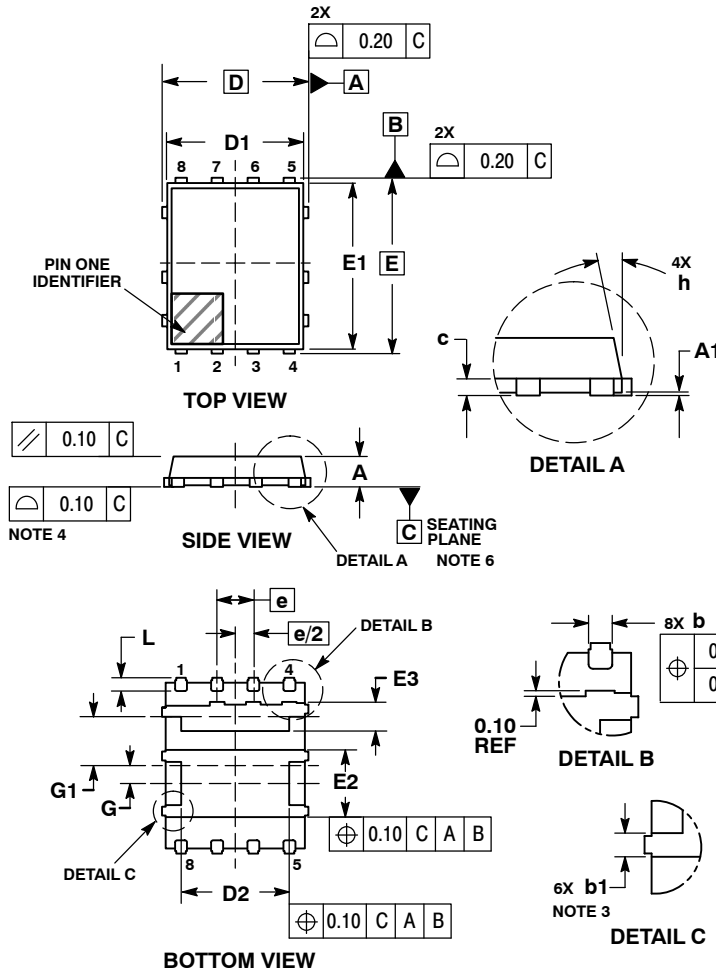


Figure 24. Thermal Response

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## PACKAGE DIMENSIONS

### DFN8 5x6, 1.27P Dual Flag (SO8FL-Dual-Asymmetrical) CASE 506BX ISSUE C

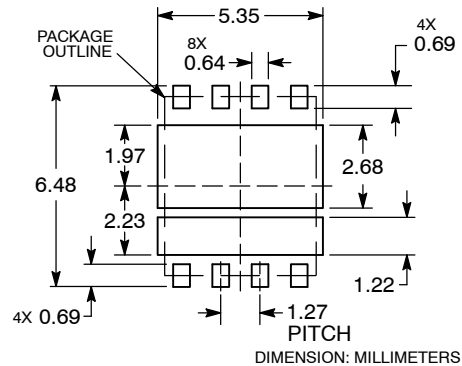


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS b AND b1 APPLY TO PLATED FEATURES AND ARE MEASURED BETWEEN 0.15 AND 0.25 MM FROM TERMINAL TIPS.
4. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
5. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
6. SEATING PLANE IS DEFINED BY THE TERMINALS. A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

| MILLIMETERS |          |      |
|-------------|----------|------|
| DIM         | MIN      | MAX  |
| A           | 0.90     | 1.10 |
| A1          | 0.00     | 0.05 |
| b           | 0.41     | 0.61 |
| b1          | 0.41     | 0.61 |
| c           | 0.23     | 0.33 |
| D           | 5.15 BSC |      |
| D1          | 4.50     | 5.10 |
| D2          | 3.50     | 4.22 |
| E           | 6.15 BSC |      |
| E1          | 5.50     | 6.10 |
| E2          | 2.27     | 2.67 |
| E3          | 0.82     | 1.22 |
| e           | 1.27 BSC |      |
| G           | 0.63 BSC |      |
| G1          | 1.72 BSC |      |
| h           | ---      | 12 ° |
| L           | 0.35     | 0.55 |

### RECOMMENDED 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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