

# NTTFS5820NL

## MOSFET – Power

**60 V, 37 A, 11.5 mΩ**

### Features

- Low  $R_{DS(on)}$
- Low Capacitance
- Optimized Gate Charge
- These Devices are Pb-Free and are RoHS Compliant

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

| Parameter   | Symbol                 | Value                     | Unit             |
|---|------------------------|---------------------------|------------------|
| Drain-to-Source Voltage   | $V_{DSS}$              | 60                        | V                |
| Gate-to-Source Voltage  | $V_{GS}$               | $\pm 20$                  | V                |
| Continuous Drain Current $R_{\theta JA}$ (Note 1)                 | $I_D$                  | $T_A = 25^\circ\text{C}$  | 11               |
|   |                        | $T_A = 100^\circ\text{C}$ | 7                |
| Power Dissipation $R_{\theta JA}$ (Note 1)                        | $P_D$                  | $T_A = 25^\circ\text{C}$  | 2.7              |
|   |                        | $T_A = 100^\circ\text{C}$ | 1.1              |
| Continuous Drain Current $R_{\theta JC}$ (Note 1)                 | $I_D$                  | $T_C = 25^\circ\text{C}$  | 37               |
|   |                        | $T_C = 100^\circ\text{C}$ | 24               |
| Power Dissipation $R_{\theta JC}$ (Note 1)                        | $P_D$                  | $T_C = 25^\circ\text{C}$  | 33               |
|   |                        | $T_C = 100^\circ\text{C}$ | 13               |
| Pulsed Drain Current  | $t_p = 10 \mu\text{s}$ | $I_{DM}$                  | 149              |
| Operating Junction and Storage Temperature                        | $T_J, T_{stg}$         | -55 to +150               | $^\circ\text{C}$ |
| Source Current (Body Diode)                                       | $I_S$                  | 37                        | A                |
| Single Pulse Drain-to-Source Avalanche Energy                     | $L = 0.1 \text{ mH}$   | $E_{AS}$                  | 48               |
|   |                        | $I_{AS}$                  | 31               |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | $T_L$                  | 260                       | $^\circ\text{C}$ |

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.

### THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter                                   | Symbol          | Value | Unit                      |
|---|-----------------|-------|---------------------------|
| Junction-to-Case – Steady State (Note 1)    | $R_{\theta JC}$ | 3.8   | $^\circ\text{C}/\text{W}$ |
| Junction-to-Ambient – Steady State (Note 1) | $R_{\theta JA}$ | 46.7  |                           |

1. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).

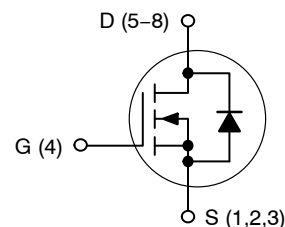


**ON Semiconductor®**

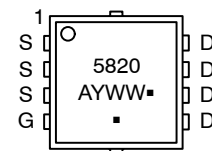
<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|---------------|------------------|-----------|
| 60 V          | 11.5 mΩ @ 10 V   | 37 A      |
|               | 15 mΩ @ 4.5 V    |           |

### N-Channel MOSFET



### MARKING DIAGRAM



5820 = Specific Device Code  
 A = Assembly Location  
 Y = Year  
 WW = Work Week  
 ■ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

| Device         | Package         | Shipping†          |
|----------------|-----------------|--------------------|
| NTTFS5820NLTAG | WDFN8 (Pb-Free) | 1500 / Tape & Reel |
| NTTFS5820NLTWG | WDFN8 (Pb-Free) | 5000 / Tape & Reel |

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

# NTTFS5820NL

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

| Parameter   | Symbol            | Test Condition                                  | Min                       | Typ | Max       | Unit          |
|---|-------------------|---|---------------------------|-----|-----------|---------------|
| <b>OFF CHARACTERISTICS</b>                                |                   |   |                           |     |           |               |
| Drain-to-Source Breakdown Voltage                         | $V_{(BR)DSS}$     | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$   | 60                        |     |           | V             |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ |   |                           | 57  |           | mV/°C         |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | $V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$     | $T_J = 25^\circ\text{C}$  |     | 1.0       | $\mu\text{A}$ |
|   |                   |   | $T_J = 125^\circ\text{C}$ |     | 10        |               |
| Gate-to-Source Leakage Current                            | $I_{GSS}$         | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ |                           |     | $\pm 100$ | nA            |

## ON CHARACTERISTICS (Note 2)

|  |                  |   |     |      |      |            |
|--|------------------|---|-----|------|------|------------|
| Gate Threshold Voltage                     | $V_{GS(TH)}$     | $V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$   | 1.5 |      | 2.3  | V          |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ |   |     | 6.2  |      | mV/°C      |
| Drain-to-Source On Resistance              | $R_{DS(on)}$     | $V_{GS} = 10\text{ V}, I_D = 8.7\text{ A}$  |     | 10.1 | 11.5 | m $\Omega$ |
|  |                  | $V_{GS} = 4.5\text{ V}, I_D = 7.3\text{ A}$ |     | 13.0 | 15   |            |
| Forward Transconductance                   | $g_{FS}$         | $V_{DS} = 5\text{ V}, I_D = 10\text{ A}$    |     | 24.6 |      | S          |

## CHARGES, CAPACITANCES AND GATE RESISTANCE

|                              |              |  |  |      |  |    |          |
|------------------------------|--------------|--|--|------|--|----|----------|
| Input Capacitance            | $C_{iss}$    | $V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 25\text{ V}$  |  | 1462 |  | pF |          |
| Output Capacitance           | $C_{oss}$    |  |  | 150  |  |    |          |
| Reverse Transfer Capacitance | $C_{rss}$    |  |  | 96   |  |    |          |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 48\text{ V}, I_D = 10\text{ A}$  |  | 28   |  | nC |          |
|                              |              | $V_{GS} = 4.5\text{ V}, V_{DS} = 48\text{ V}, I_D = 10\text{ A}$ |  | 15   |  |    |          |
| Threshold Gate Charge        | $Q_{G(TH)}$  | $V_{GS} = 4.5\text{ V}, V_{DS} = 48\text{ V}, I_D = 10\text{ A}$ |  | 1    |  | nC |          |
| Gate-to-Source Charge        | $Q_{GS}$     |  |  | 4    |  |    |          |
| Gate-to-Drain Charge         | $Q_{GD}$     |  |  | 8    |  |    |          |
| Plateau Voltage              | $V_{GP}$     |  |  | 3    |  |    | V        |
| Gate Resistance              | $R_G$        |  |  | 0.62 |  |    | $\Omega$ |

## SWITCHING CHARACTERISTICS (Note 3)

|                     |              |   |  |    |  |    |
|---------------------|--------------|---|--|----|--|----|
| Turn-On Delay Time  | $t_{d(on)}$  | $V_{GS} = 4.5\text{ V}, V_{DS} = 48\text{ V}, I_D = 10\text{ A}, R_G = 2.5\ \Omega$ |  | 10 |  | ns |
| Rise Time           | $t_r$        |   |  | 28 |  |    |
| Turn-Off Delay Time | $t_{d(off)}$ |   |  | 19 |  |    |
| Fall Time           | $t_f$        |   |  | 22 |  |    |

## DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |          |  |                           |    |      |     |    |
|-------------------------|----------|--|---------------------------|----|------|-----|----|
| Forward Diode Voltage   | $V_{SD}$ | $V_{GS} = 0\text{ V}, I_S = 10\text{ A}$                                     | $T_J = 25^\circ\text{C}$  |    | 0.79 | 1.2 | V  |
|                         |          |  | $T_J = 125^\circ\text{C}$ |    | 0.65 |     |    |
| Reverse Recovery Time   | $t_{RR}$ | $V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}, I_S = 10\text{ A}$ |                           | 19 |      | ns  |    |
| Charge Time             | $t_a$    |  |                           | 13 |      |     |    |
| Discharge Time          | $t_b$    |  |                           | 6  |      |     |    |
| Reverse Recovery Charge | $Q_{RR}$ |  |                           | 15 |      |     | nC |

- Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

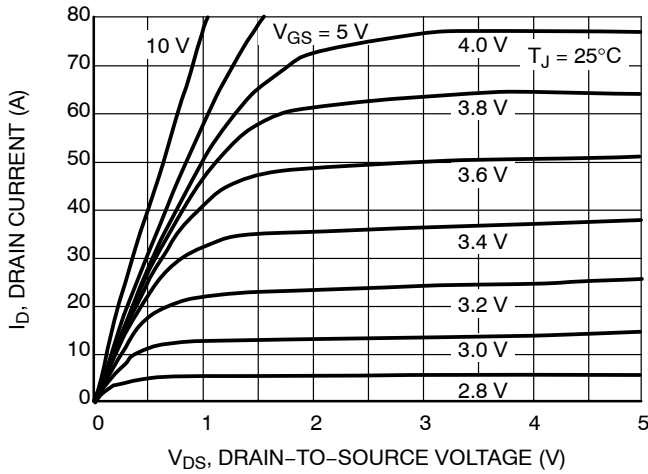


Figure 1. On-Region Characteristics

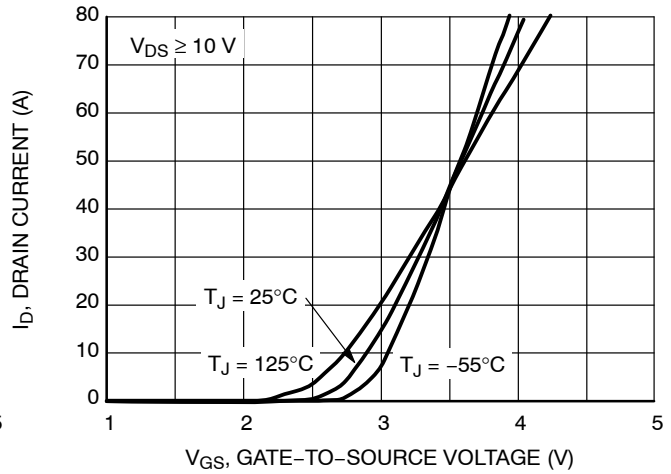


Figure 2. Transfer Characteristics

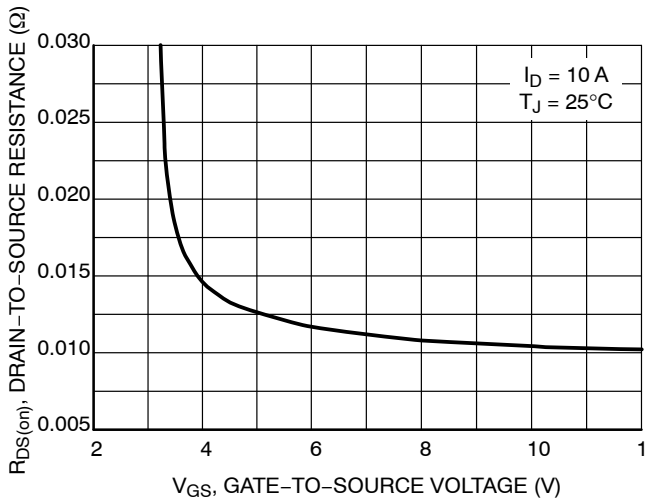


Figure 3. On-Resistance vs. Gate-to-Source Voltage

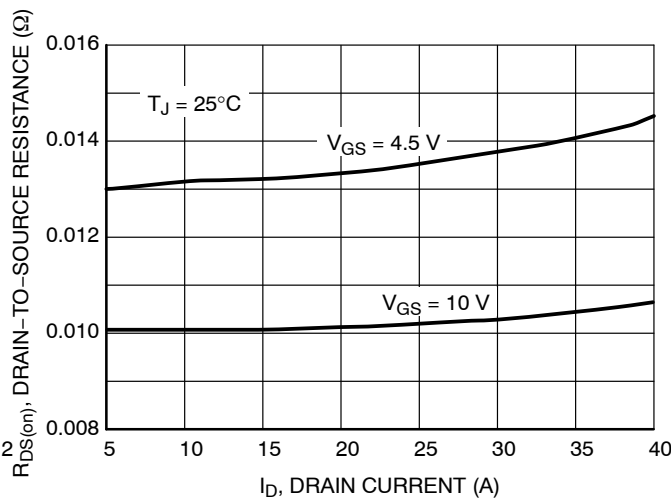


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

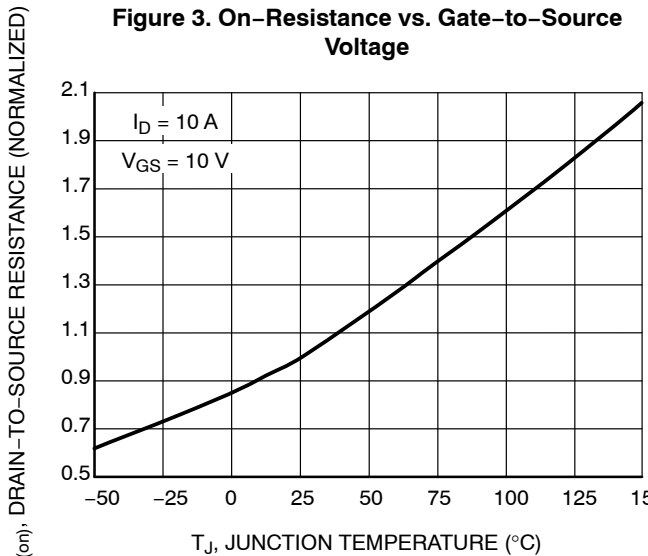


Figure 5. On-Resistance Variation with Temperature

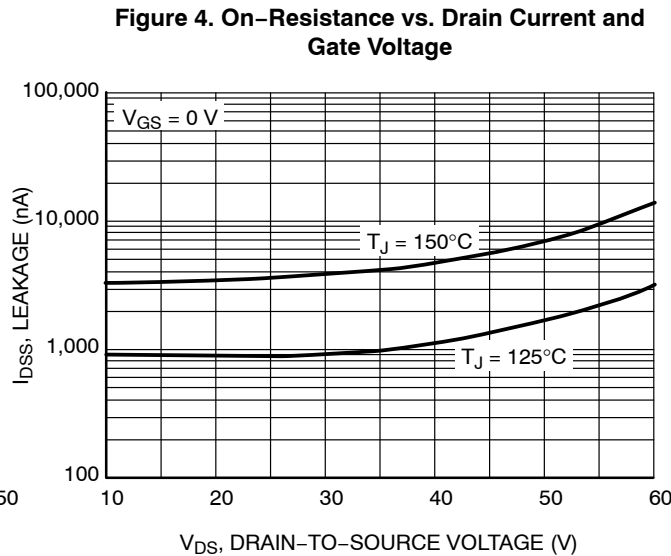


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

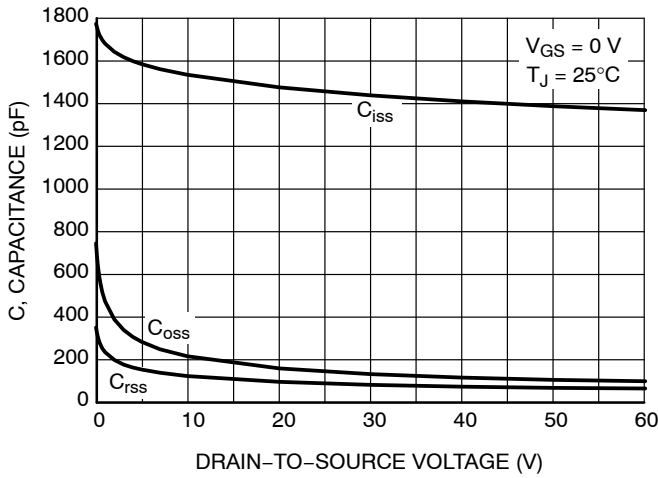


Figure 7. Capacitance Variation

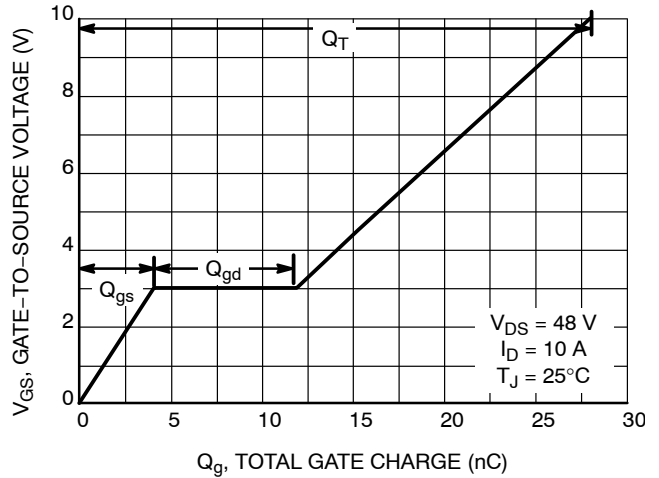


Figure 8. Gate-to-Source Voltage vs. Total Charge

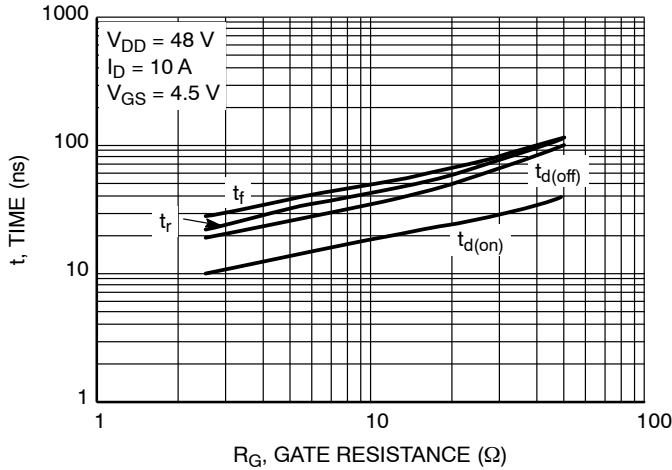


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

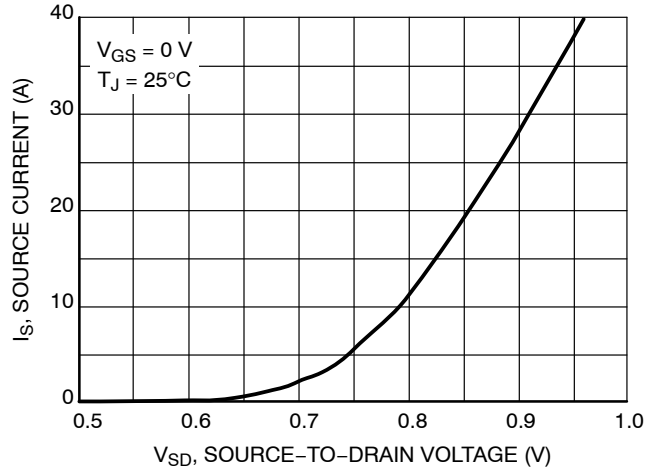


Figure 10. Diode Forward Voltage vs. Current

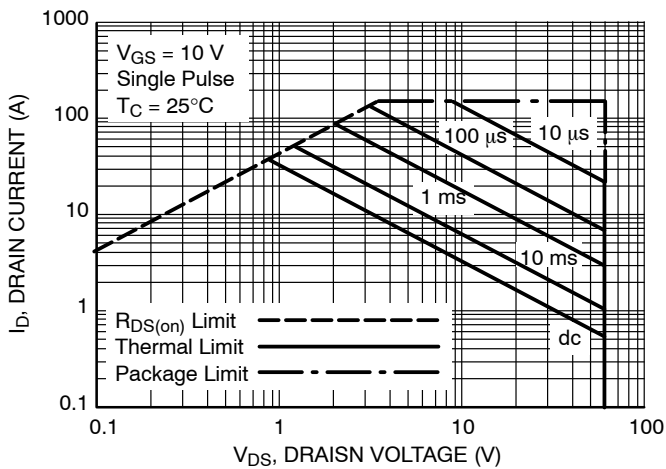


Figure 11. Maximum Rated Forward Biased Safe Operating Area

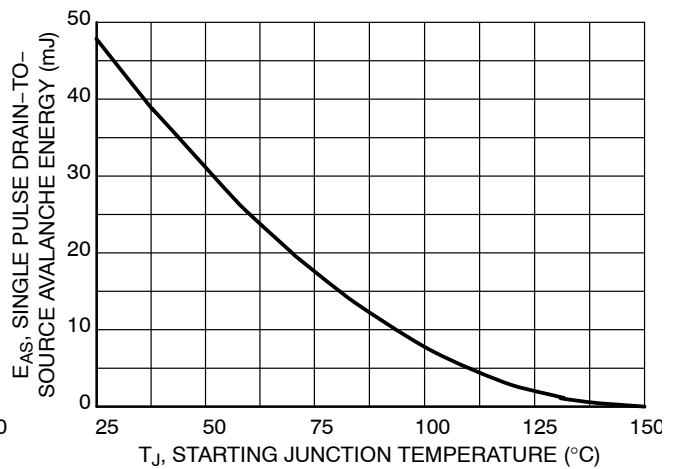


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

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## TYPICAL CHARACTERISTICS

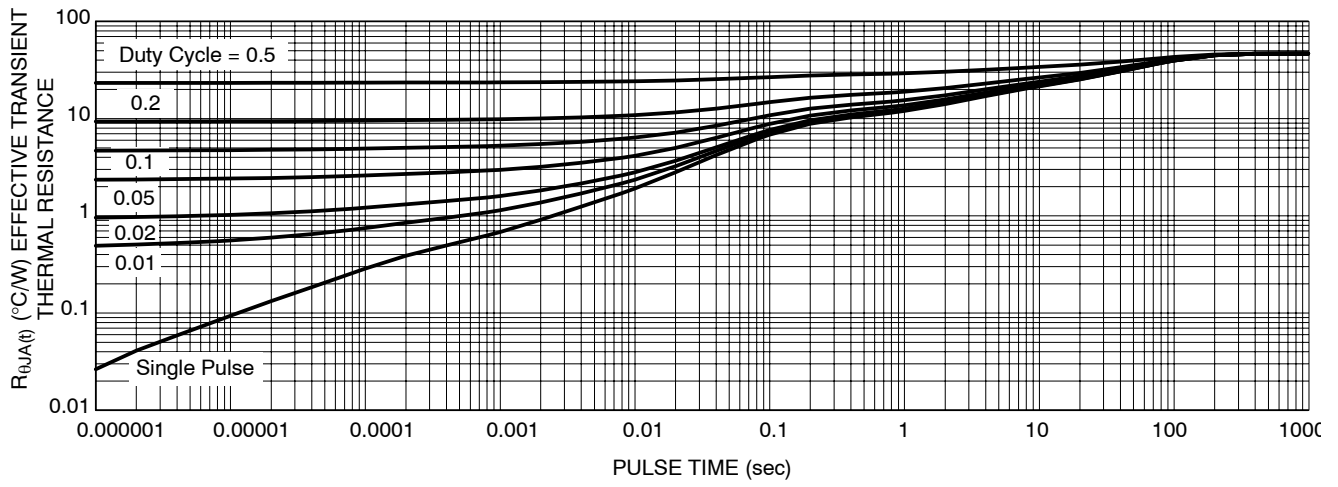
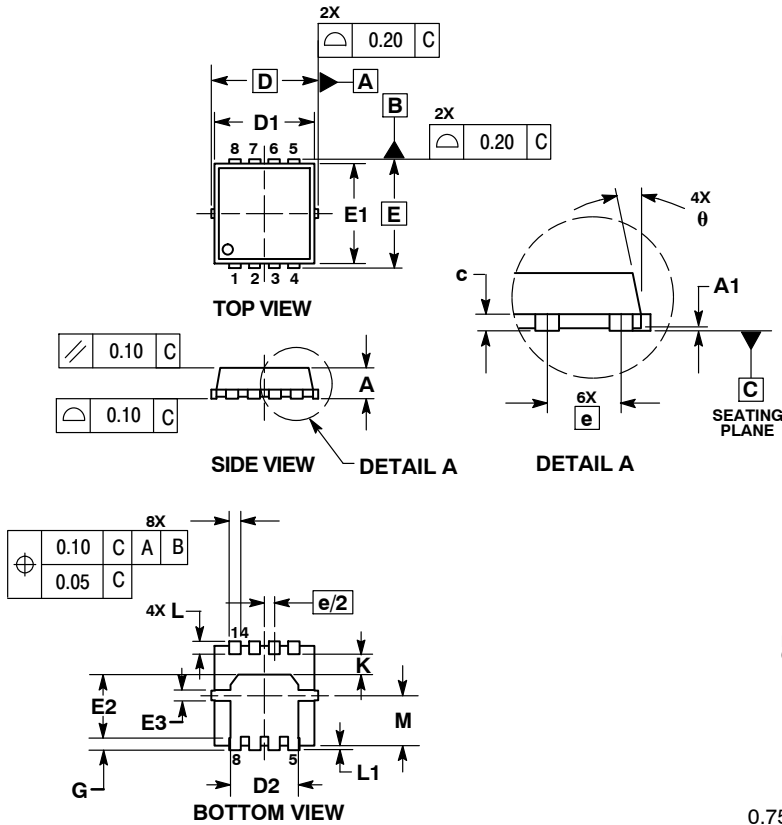


Figure 13. Thermal Response

# NTTFS5820NL

## PACKAGE DIMENSIONS

WDFN8 3.3x3.3, 0.65P  
CASE 511AB  
ISSUE C

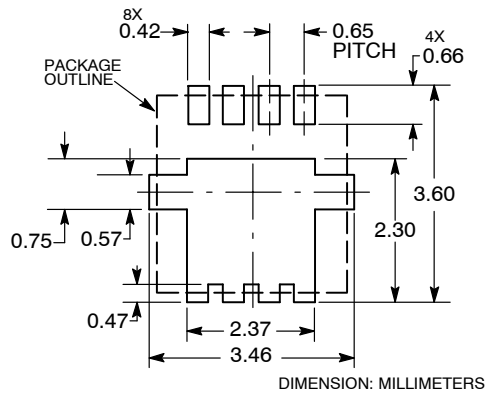


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

| DIM | MILLIMETERS |      |      | INCHES    |       |       |
|-----|-------------|------|------|-----------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN       | NOM   | MAX   |
| A   | 0.70        | 0.75 | 0.80 | 0.028     | 0.030 | 0.031 |
| A1  | 0.00        | ---  | 0.05 | 0.000     | ---   | 0.002 |
| a   | 0.23        | 0.30 | 0.40 | 0.009     | 0.012 | 0.016 |
| c   | 0.15        | 0.20 | 0.25 | 0.006     | 0.008 | 0.010 |
| D   | 3.30 BSC    |      |      | 0.130 BSC |       |       |
| D1  | 2.95        | 3.05 | 3.15 | 0.116     | 0.120 | 0.124 |
| D2  | 1.98        | 2.11 | 2.24 | 0.078     | 0.083 | 0.088 |
| E   | 3.30 BSC    |      |      | 0.130 BSC |       |       |
| E1  | 2.95        | 3.05 | 3.15 | 0.116     | 0.120 | 0.124 |
| E2  | 1.47        | 1.60 | 1.73 | 0.058     | 0.063 | 0.068 |
| E3  | 0.23        | 0.30 | 0.40 | 0.009     | 0.012 | 0.016 |
| e   | 0.65 BSC    |      |      | 0.026 BSC |       |       |
| g   | 0.30        | 0.41 | 0.51 | 0.012     | 0.016 | 0.020 |
| K   | 0.64        | ---  | ---  | 0.025     | ---   | ---   |
| L   | 0.30        | 0.43 | 0.56 | 0.012     | 0.017 | 0.022 |
| L1  | 0.06        | 0.13 | 0.20 | 0.002     | 0.005 | 0.008 |
| M   | 1.40        | 1.50 | 1.60 | 0.055     | 0.059 | 0.063 |
| θ   | 0°          | ---  | 12°  | 0°        | ---   | 12°   |

**SOLDERING FOOTPRINT\***



DIMENSION: MILLIMETERS

\*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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