

# MOSFET - Power, Single N-Channel, Logic Level, $\mu$ 8FL

80 V, 5.3 m $\Omega$ , 79 A

## NTTFS5D6N08XL

### Features

- Low  $Q_{RR}$ , Soft Recovery Body Diode
- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low  $Q_G$  and Capacitance to Minimize Driver Losses
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Typical Applications

- Synchronous Rectification (SR) in DC-DC and AC-DC
- Primary Switch in Isolated DC-DC Converter
- Motor Drives

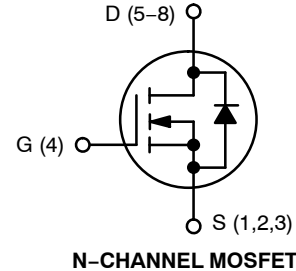
### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

| Parameter  | Symbol         | Value   | Unit             |
|--|----------------|---|------------------|
| Drain-to-Source Voltage  | $V_{DSS}$      | 80  | V                |
| Gate-to-Source Voltage   | $V_{GS}$       | $\pm 20$  | V                |
| Continuous Drain Current (Notes 1, 2)                              | $I_D$          | $T_C = 25^\circ\text{C}$                        | 79               |
|  |                | $T_C = 100^\circ\text{C}$                       | 56               |
| Power Dissipation (Note 1)   | $P_D$          | $T_C = 25^\circ\text{C}$                        | 82               |
|  |                | $T_C = 100^\circ\text{C}$                       | 41               |
| Pulsed Drain Current   | $I_{DM}$       | $T_C = 25^\circ\text{C}, t_p = 100 \mu\text{s}$ | 290              |
| Pulsed Source Current (Body Diode)                                 |                |   | $I_{SM}$         |
| Operating Junction and Storage Temperature Range                   | $T_J, T_{STG}$ | -55 to +175                                     | $^\circ\text{C}$ |
| Source Current (Body Diode)  | $I_S$          | 118   | A                |
| Single Pulse Avalanche Energy ( $I_{PK} = 34 \text{ A}$ ) (Note 3) | $E_{AS}$       | 57  | mJ               |
| 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. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Actual continuous current will be limited by thermal & electromechanical application board design.
3.  $E_{AS}$  of 57 mJ is based on  $T_J = 25^\circ\text{C}$ ;  $L = 0.1 \text{ mH}$ ,  $I_{AS} = 34 \text{ A}$ ,  $V_{DD} = 64 \text{ V}$ ,  $V_{GS} = 10 \text{ V}$ . 100% tested

| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX       | $I_D$ MAX |
|---------------|------------------------|-----------|
| 80 V          | 5.3 m $\Omega$ @ 10 V  | 79 A      |
|               | 8.4 m $\Omega$ @ 4.5 V |           |



### MARKING DIAGRAM



S5D6 = Specific Device Code  
A = Assembly Location  
Y = Year Code  
WW = Work Week Code

### ORDERING INFORMATION

| Device           | Package            | Shipping <sup>†</sup> |
|------------------|--------------------|-----------------------|
| NTTFS5D6N08XLTAG | WDFN8 ( $\mu$ 8FL) | 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 Specification Brochure, BRD8011/D.

# NTTFS5D6N08XL

## THERMAL CHARACTERISTICS

| Parameter  | Symbol          | Value | Unit                        |
|--|-----------------|-------|-----------------------------|
| Thermal Resistance, Junction-to-Case                 | $R_{\theta JC}$ | 1.8   | $^{\circ}\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Ambient (Notes 4, 5) | $R_{\theta JA}$ | 46    |                             |

4. Surface-mounted on FR4 board using a 1 in<sup>2</sup>, 1 oz. Cu pad.

5.  $R_{\theta JA}$  is determined by the user's board design.

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

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|-----------|--------|-----------------|-----|-----|-----|------|
|-----------|--------|-----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|   |                                   |  |    |    |     |                              |
|---|-----------------------------------|--|----|----|-----|------------------------------|
| Drain-to-Source Breakdown Voltage                         | $V_{(BR)DSS}$                     | $V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$                 | 80 |    |     | V                            |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $\Delta V_{(BR)DSS} / \Delta T_J$ | $I_D = 1\text{ mA}$ . Referenced to $25^{\circ}\text{C}$ |    | 31 |     | $\text{mV}/^{\circ}\text{C}$ |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$                         | $V_{DS} = 80\text{ V}$                                   |    |    | 1   | $\mu\text{A}$                |
|   |                                   | $V_{DS} = 80\text{ V}, T_J = 125^{\circ}\text{C}$        |    |    | 250 |                              |
| Gate-to-Source Leakage Current                            | $I_{GSS}$                         | $V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$              |    |    | 100 | nA                           |

### ON CHARACTERISTICS

|  |                                  |  |     |      |     |                              |
|--|----------------------------------|--|-----|------|-----|------------------------------|
| Drain-to-Source On Resistance                  | $R_{DS(on)}$                     | $V_{GS} = 10\text{ V}, I_D = 17\text{ A}$      |     | 4.3  | 5.3 | $\text{m}\Omega$             |
|  |                                  | $V_{GS} = 4.5\text{ V}, I_D = 14\text{ A}$     |     | 5.7  | 8.4 |                              |
| Gate Threshold Voltage                         | $V_{GS(TH)}$                     | $V_{GS} = V_{DS}, I_D = 85\text{ }\mu\text{A}$ | 1.5 |      | 2.1 | V                            |
| Gate Threshold Voltage Temperature Coefficient | $\Delta V_{GS(TH)} / \Delta T_J$ | $V_{GS} = V_{DS}, I_D = 85\text{ }\mu\text{A}$ |     | -6.4 |     | $\text{mV}/^{\circ}\text{C}$ |
| Forward Transconductance                       | $g_{FS}$                         | $V_{DS} = 5\text{ V}, I_D = 17\text{ A}$       |     | 113  |     | S                            |

### CHARGES, CAPACITANCES & GATE RESISTANCE

|                              |              |  |  |      |  |               |
|------------------------------|--------------|--|--|------|--|---------------|
| Input Capacitance            | $C_{ISS}$    | $V_{GS} = 0\text{ V}, V_{DS} = 40\text{ V}, f = 1\text{ MHz}$    |  | 1800 |  | $\mu\text{F}$ |
| Output Capacitance           | $C_{OSS}$    |  |  | 450  |  |               |
| Reverse Transfer Capacitance | $C_{RSS}$    |  |  | 14   |  |               |
| Output Charge                | $Q_{OSS}$    |  |  | 33   |  |               |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DD} = 40\text{ V}; I_D = 17\text{ A}$ |  | 14   |  | nC            |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 10\text{ V}, V_{DD} = 40\text{ V}; I_D = 17\text{ A}$  |  | 28   |  |               |
| Threshold Gate Charge        | $Q_{G(TH)}$  |  |  | 3    |  |               |
| Gate-to-Source Charge        | $Q_{GS}$     |  |  | 5    |  |               |
| Gate-to-Drain Charge         | $Q_{GD}$     |  |  | 4    |  |               |
| Gate Plateau Voltage         | $V_{GP}$     |  |  | 2.7  |  |               |
| Gate Resistance              | $R_G$        | $f = 1\text{ MHz}$   |  | 0.6  |  | $\Omega$      |

### SWITCHING CHARACTERISTICS

|                     |              |  |  |    |  |    |
|---------------------|--------------|--|--|----|--|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | Resistive Load,<br>$V_{GS} = 0/10\text{ V}, V_{DD} = 40\text{ V},$<br>$I_D = 17\text{ A}, R_G = 2.5\text{ }\Omega$ |  | 10 |  | ns |
| Rise Time           | $t_r$        |  |  | 3  |  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |  |  | 24 |  |    |
| Fall Time           | $t_f$        |  |  | 3  |  |    |

### SOURCE-TO-DRAIN DIODE CHARACTERISTICS

|                         |          |  |  |     |     |    |
|-------------------------|----------|--|--|-----|-----|----|
| Forward Diode Voltage   | $V_{SD}$ | $V_{GS} = 0\text{ V}, I_S = 17\text{ A}$   |  | 0.8 | 1.2 | V  |
|                         |          | $V_{GS} = 0\text{ V}, I_S = 17\text{ A}, T_J = 125^{\circ}\text{C}$                                    |  | 0.7 |     |    |
| Reverse Recovery Time   | $t_{RR}$ | $V_{GS} = 0\text{ V}, di/dt = 1000\text{ A}/\mu\text{s},$<br>$I_S = 17\text{ A}, V_{DD} = 40\text{ V}$ |  | 19  |     | ns |
| Charge Time             | $t_a$    |  |  | 11  |     |    |
| Discharge Time          | $t_b$    |  |  | 8   |     |    |
| Reverse Recovery Charge | $Q_{RR}$ |  |  | 96  |     |    |

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.

# NTTFS5D6N08XL

## TYPICAL CHARACTERISTICS

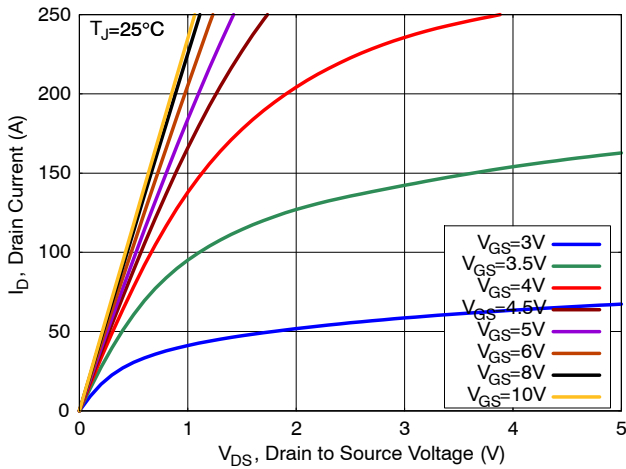


Figure 1. On-Region Characteristics

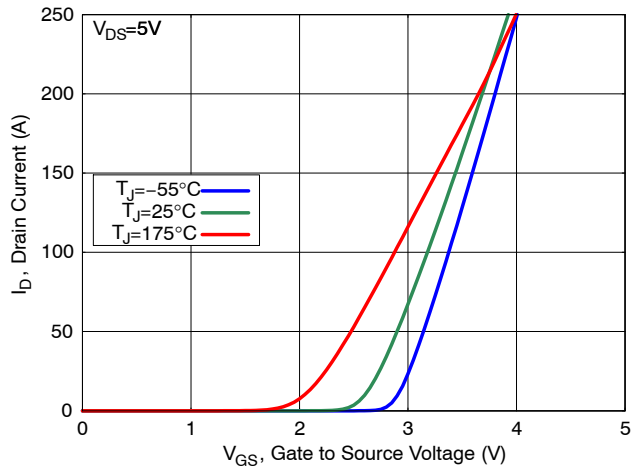


Figure 2. Transfer Characteristics

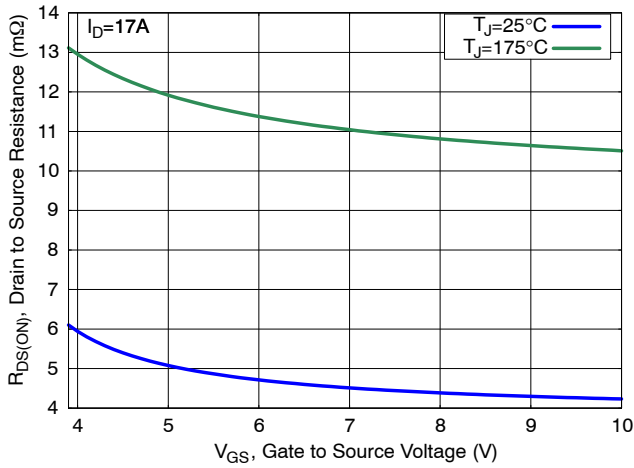


Figure 3. On-Resistance vs. Gate Voltage

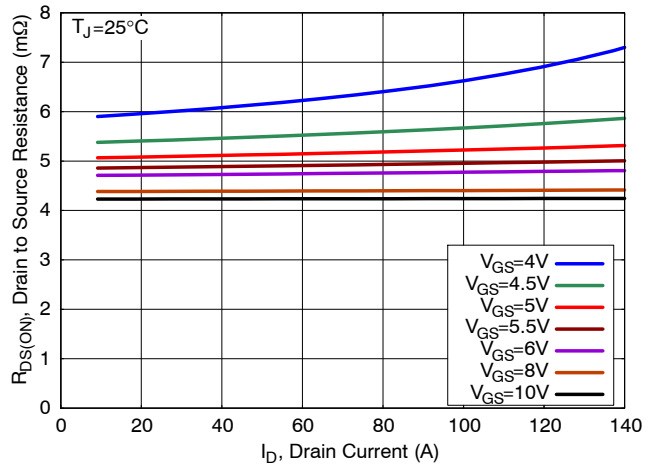


Figure 4. On-Resistance vs. Drain Current

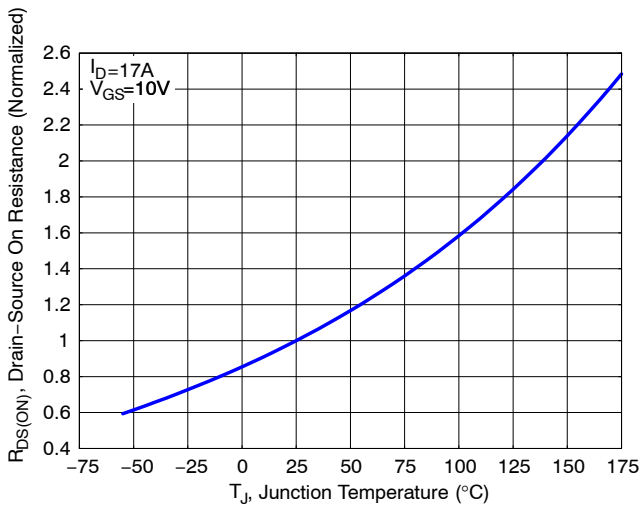


Figure 5. Normalized ON Resistance vs. Junction Temperature

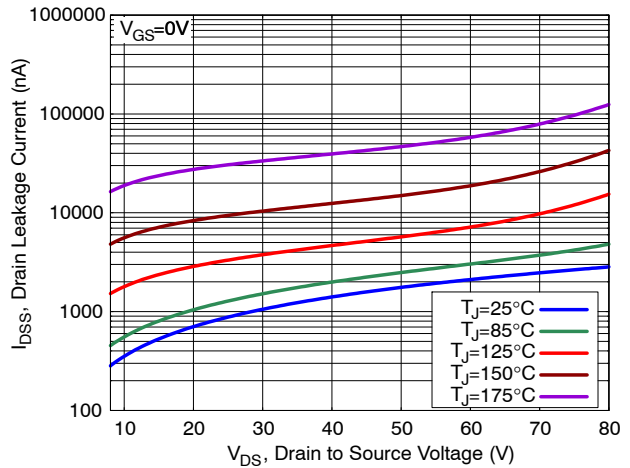


Figure 6. Drain Leakage Current vs. Drain Voltage

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## TYPICAL CHARACTERISTICS

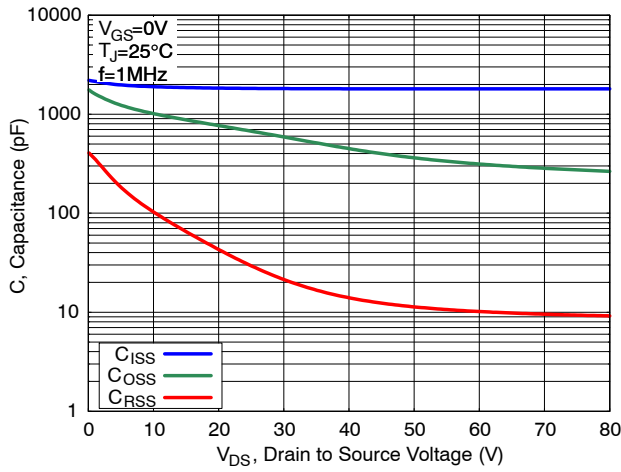


Figure 7. Capacitance Characteristics

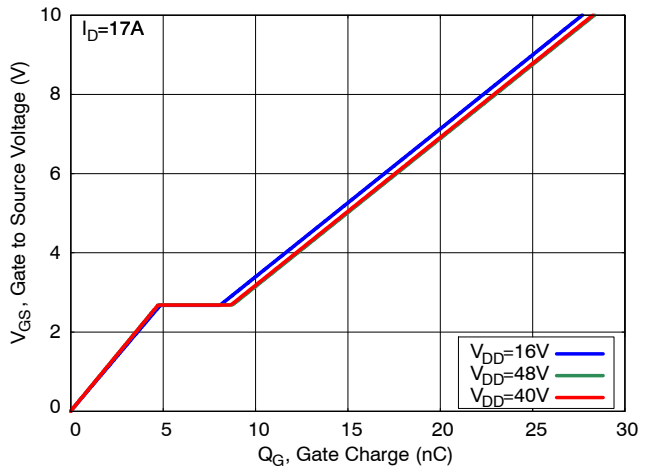


Figure 8. Gate Charge Characteristics

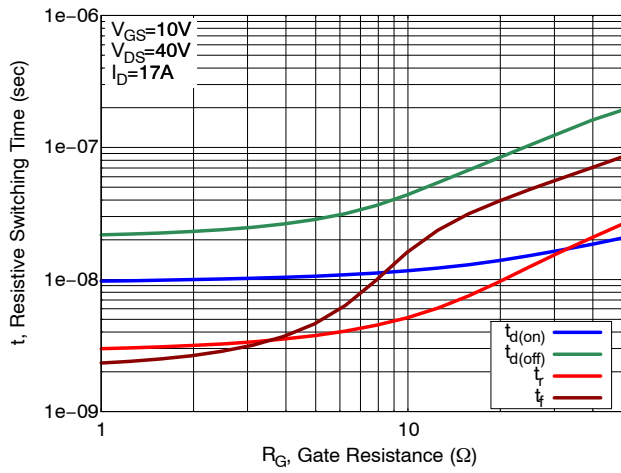


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

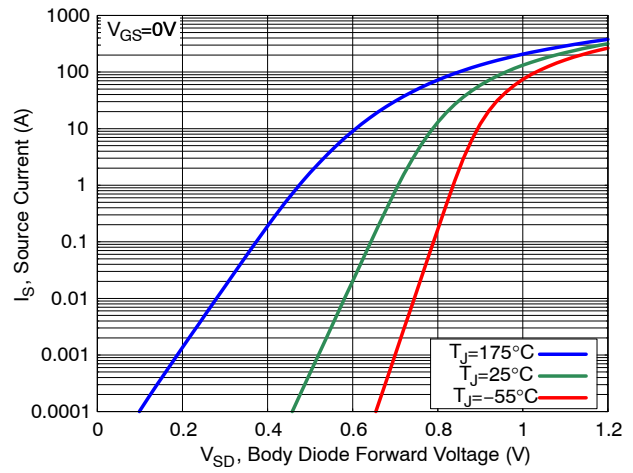


Figure 10. Diode Forward Characteristics

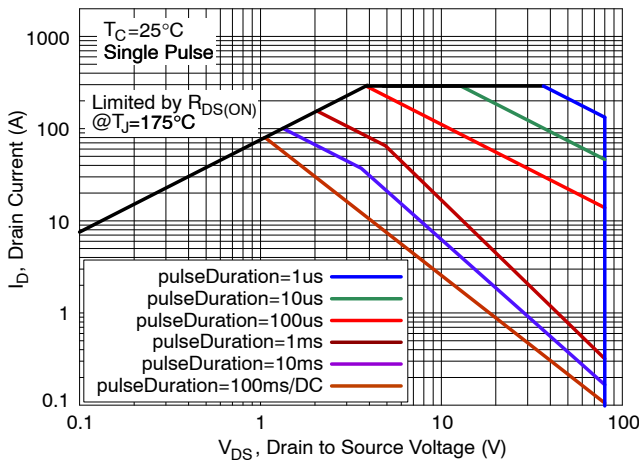


Figure 11. Safe Operating Area (SOA)

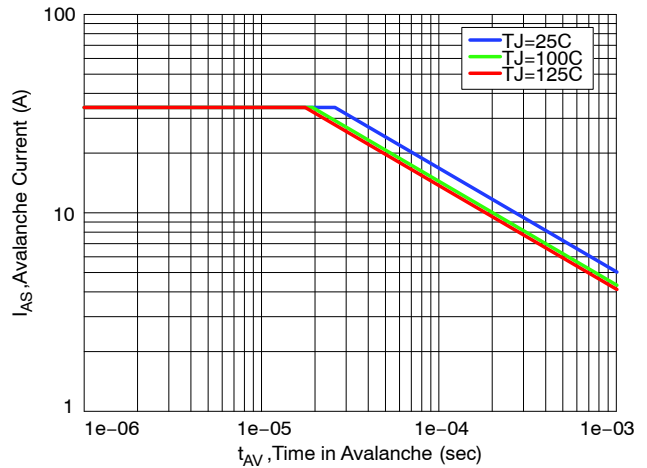
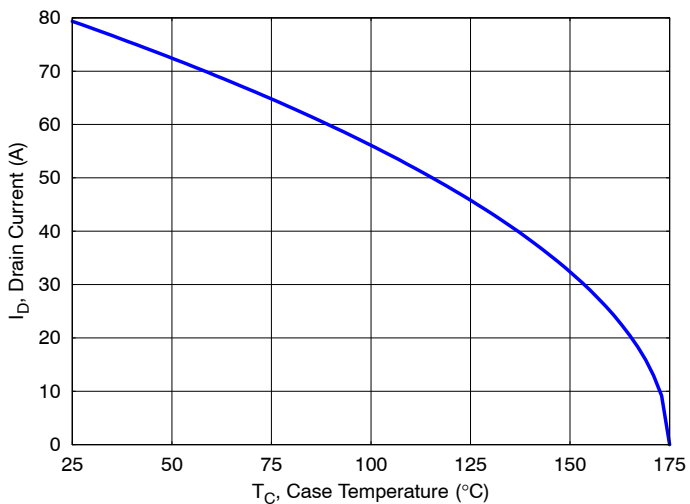


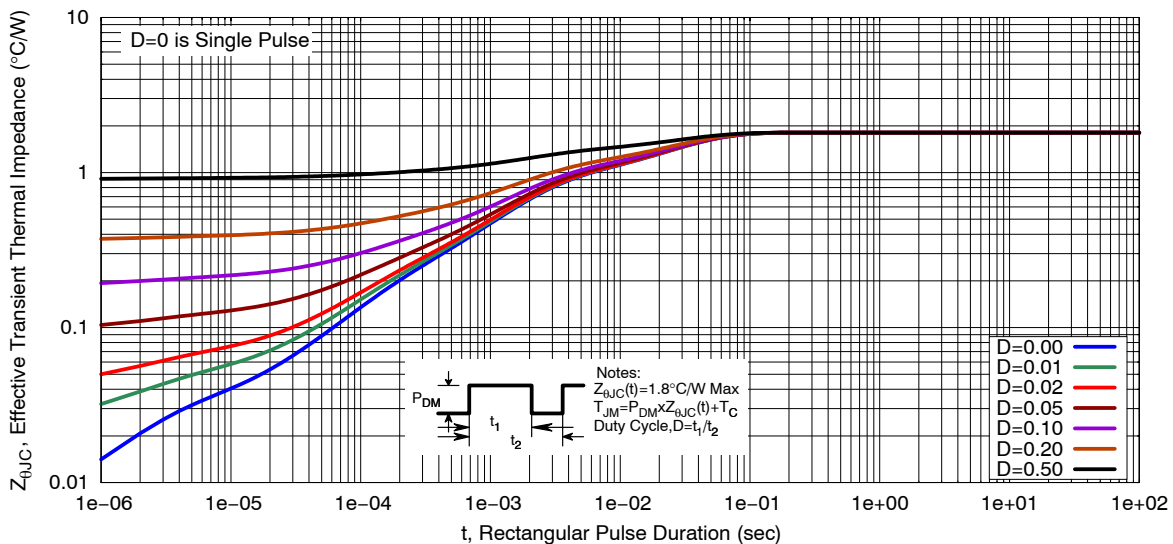
Figure 12. Avalanche Current vs. Pulse Time (UIS)

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## TYPICAL CHARACTERISTICS



**Figure 13. Maximum Current vs. Case Temperature**

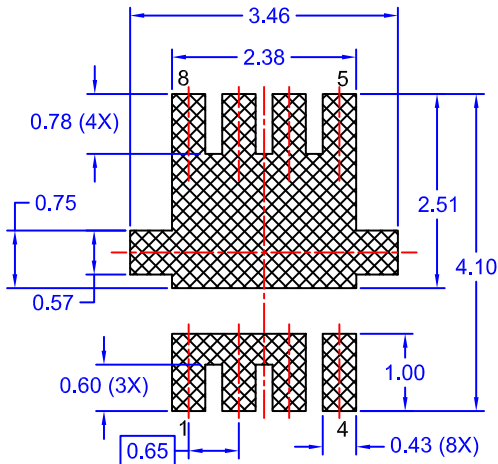
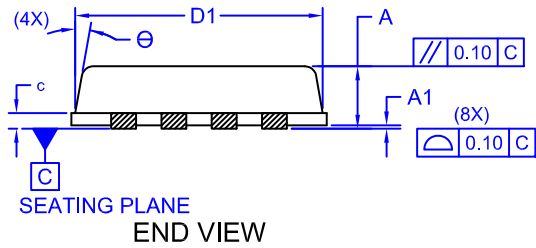
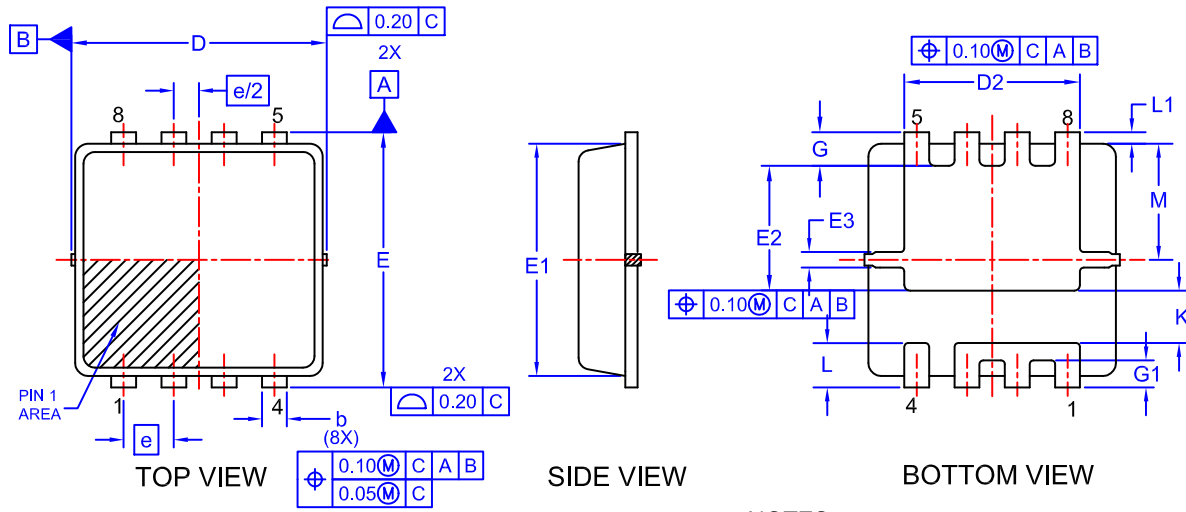


**Figure 14. Transient Thermal Response**

# NTTFS5D6N08XL

## PACKAGE DIMENSIONS

WDFN8 3.3x3.3, 0.65P  
CASE 511DY  
ISSUE A



### NOTES:

1. CONTROLLING DIMENSION: MILLIMETERS
2. DIMENSIONS D1 & E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS NOR GATE BURRS.

| DIM      | MILLIMETERS |      |      |
|----------|-------------|------|------|
|          | MIN         | NOM  | MAX  |
| A        | 0.70        | 0.75 | 0.80 |
| A1       | 0.00        | -    | 0.05 |
| b        | 0.23        | 0.33 | 0.43 |
| c        | 0.15        | 0.20 | 0.25 |
| D        | 3.20        | 3.30 | 3.40 |
| D1       | 2.95        | 3.13 | 3.30 |
| D2       | 1.98        | 2.20 | 2.40 |
| E        | 3.20        | 3.30 | 3.40 |
| E1       | 2.80        | 3.00 | 3.15 |
| E2       | 1.40        | 1.60 | 1.80 |
| E3       | 0.15        | 0.25 | 0.40 |
| e        | 0.65 BSC    |      |      |
| G        | 0.30        | 0.43 | 0.55 |
| G1       | 0.25        | 0.35 | 0.45 |
| K        | 0.55        | 0.75 | 0.95 |
| L        | 0.35        | 0.52 | 0.65 |
| L1       | 0.06        | 0.15 | 0.30 |
| M        | 1.35        | 1.50 | 1.60 |
| $\theta$ | 0           | -    | 12   |

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