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# MOSFET - Power, Single N-Channel, TOLL

## 80 V, 1.7 mΩ, 203 A



## NTBLS1D7N08H

### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low  $Q_G$  and Capacitance to Minimize Driver Losses
- Lowers Switching Noise/EMI
- These Devices are Pb-Free and are RoHS Compliant

### Typical Applications

- Power Tools, Battery Operated Vacuums
- UAV/Drones, Material Handling
- BMS/Storage, Home Automation

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

| Parameter   |   | Symbol                    | Value       | Unit |
|---|---|---------------------------|-------------|------|
| Drain-to-Source Voltage   |   | $V_{DSS}$                 | 80          | V    |
| Gate-to-Source Voltage  |   | $V_{GS}$                  | $\pm 20$    | V    |
| Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)                       | Steady State  | $T_C = 25^\circ\text{C}$  | $I_D$       | A    |
|   |   | $T_C = 100^\circ\text{C}$ | 143         |      |
| Power Dissipation $R_{\theta JC}$ (Note 1)                                  |   | $T_C = 25^\circ\text{C}$  | $P_D$       | W    |
|   |   | $T_C = 100^\circ\text{C}$ | 83          |      |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)                    | Steady State  | $T_A = 25^\circ\text{C}$  | $I_D$       | A    |
|   |   | $T_A = 100^\circ\text{C}$ | 21          |      |
| Power Dissipation $R_{\theta JA}$ (Notes 1, 2)                              |   | $T_A = 25^\circ\text{C}$  | $P_D$       | W    |
|   |   | $T_A = 100^\circ\text{C}$ | 1.7         |      |
| Pulsed Drain Current  | $T_C = 25^\circ\text{C}$ , $t_p = 100\ \mu\text{s}$ | $I_{DM}$                  | 1173        | A    |
| Operating Junction and Storage Temperature Range                            |   | $T_J$ , $T_{stg}$         | -55 to +175 | °C   |
| Source Current (Body Diode)   |   | $I_S$                     | 139         | A    |
| Single Pulse Drain-to-Source Avalanche Energy ( $I_{L(pk)} = 27\text{ A}$ ) |   | $E_{AS}$                  | 1093.5      | mJ   |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s)           |   | $T_L$                     | 260         | °C   |

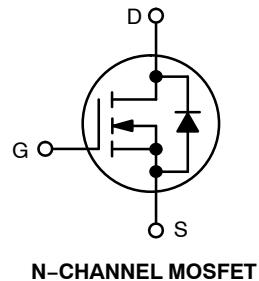
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL RESISTANCE MAXIMUM RATINGS

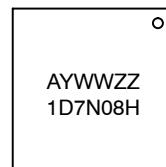
| Parameter                                       | Symbol          | Value | Unit |
|---|-----------------|-------|------|
| Junction-to-Case - Steady State (Note 1)        | $R_{\theta JC}$ | 0.9   | °C/W |
| Junction-to-Ambient - Steady State (Notes 1, 2) | $R_{\theta JA}$ | 43    |      |

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. Surface-mounted on FR4 board using a 650 mm<sup>2</sup>, 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

| $V_{(BR)DSS}$ | $R_{DS(ON)}\text{ MAX}$ | $I_D\text{ MAX}$ |
|---------------|-------------------------|------------------|
| 80 V          | 1.7 mΩ @ 10 V           | 203 A            |



### MARKING DIAGRAM



1D7N08H = Specific Device Code

A = Assembly Location

Y = Year

WW = Work Week

ZZ = Lot Traceability

### ORDERING INFORMATION

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

# NTBLS1D7N08H

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

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

### OFF CHARACTERISTICS

|   |                                      |  |                        |    |    |     |       |
|---|--------------------------------------|--|------------------------|----|----|-----|-------|
| Drain-to-Source Breakdown Voltage                         | V <sub>(BR)DSS</sub>                 | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA   |                        | 80 |    |     | V     |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V <sub>(BR)DSS</sub> /T <sub>J</sub> |  |                        |    | 57 |     | mV/°C |
| Zero Gate Voltage Drain Current                           | I <sub>DSS</sub>                     | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 80 V | T <sub>J</sub> = 25 °C |    |    | 10  | μA    |
|   |                                      |  | T <sub>J</sub> = 125°C |    |    | 250 |       |
| Gate-to-Source Leakage Current                            | I <sub>GSS</sub>                     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = 20 V    |                        |    |    | 100 | nA    |

### ON CHARACTERISTICS

|                                   |                                     |   |                       |     |      |     |       |
|-----------------------------------|-------------------------------------|---|-----------------------|-----|------|-----|-------|
| Gate Threshold Voltage            | V <sub>GS(TH)</sub>                 | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 479 μA |                       | 2.0 | 2.9  | 4.0 | V     |
| Threshold Temperature Coefficient | V <sub>GS(TH)</sub> /T <sub>J</sub> | I <sub>D</sub> = 479 μA, ref to 25°C                        |                       |     | -7.3 |     | mV/°C |
| Drain-to-Source On Resistance     | R <sub>DSS(on)</sub>                | V <sub>GS</sub> = 10 V                                      | I <sub>D</sub> = 80 A |     | 1.29 | 1.7 | mΩ    |
|                                   |                                     | V <sub>GS</sub> = 6 V                                       | I <sub>D</sub> = 43 A |     | 1.76 | 2.6 |       |
| Forward Transconductance          | g <sub>FS</sub>                     | V <sub>DS</sub> = 5 V, I <sub>D</sub> = 80 A                |                       |     | 271  |     | S     |

### CHARGES, CAPACITANCES & GATE RESISTANCE

|                              |                     |   |   |      |  |    |
|------------------------------|---------------------|---|---|------|--|----|
| Input Capacitance            | C <sub>ISS</sub>    | V <sub>GS</sub> = 0 V, f = 1 MHz, V <sub>DS</sub> = 40 V              |   | 7675 |  | pF |
| Output Capacitance           | C <sub>OSS</sub>    |   |   | 1059 |  |    |
| Reverse Transfer Capacitance | C <sub>rss</sub>    |   |   | 41   |  |    |
| Gate-Resistance              | R <sub>G</sub>      |   |   | 0.6  |  |    |
| Total Gate Charge            | Q <sub>G(TOT)</sub> | V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 40 V; I <sub>D</sub> = 80 A |   | 121  |  | nC |
| Threshold Gate Charge        | Q <sub>G(TH)</sub>  |   |   | 19   |  |    |
| Gate-to-Source Charge        | Q <sub>GS</sub>     |   |   | 32   |  |    |
| Gate-to-Drain Charge         | Q <sub>GD</sub>     |   |   | 29   |  |    |
| Plateau Voltage              | V <sub>GP</sub>     |   |   | 4.5  |  |    |
| Output Charge                | Q <sub>OSS</sub>    |   | V <sub>GS</sub> = 0 V, V <sub>DD</sub> = 40 V | 149  |  | nC |

### SWITCHING CHARACTERISTICS (Note 4)

|                     |                     |  |  |    |  |    |
|---------------------|---------------------|--|--|----|--|----|
| Turn-On Delay Time  | t <sub>d(ON)</sub>  | V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 40 V,<br>I <sub>D</sub> = 80 A, R <sub>G</sub> = 6 Ω |  | 29 |  | ns |
| Rise Time           | t <sub>r</sub>      |  |  | 25 |  |    |
| Turn-Off Delay Time | t <sub>d(OFF)</sub> |  |  | 89 |  |    |
| Fall Time           | t <sub>f</sub>      |  |  | 35 |  |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |                 |   |                        |  |      |     |    |
|-------------------------|-----------------|---|------------------------|--|------|-----|----|
| Forward Diode Voltage   | V <sub>SD</sub> | V <sub>GS</sub> = 0 V,<br>I <sub>S</sub> = 80 A                                 | T <sub>J</sub> = 25°C  |  | 0.82 | 1.2 | V  |
|                         |                 |   | T <sub>J</sub> = 125°C |  | 0.69 |     |    |
| Reverse Recovery Time   | t <sub>RR</sub> | V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs,<br>I <sub>S</sub> = 43 A |                        |  | 73   |     | ns |
| Reverse Recovery Charge | Q <sub>RR</sub> |   |                        |  | 138  |     | nC |

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.

4. Switching characteristics are independent of operating junction temperatures.

## TYPICAL CHARACTERISTICS

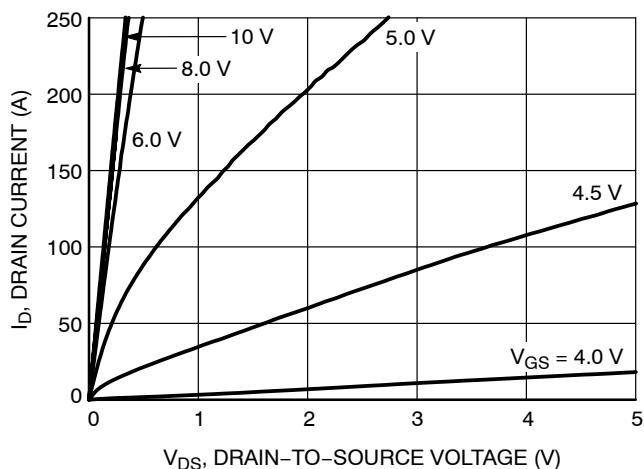


Figure 1. On-Region Characteristics

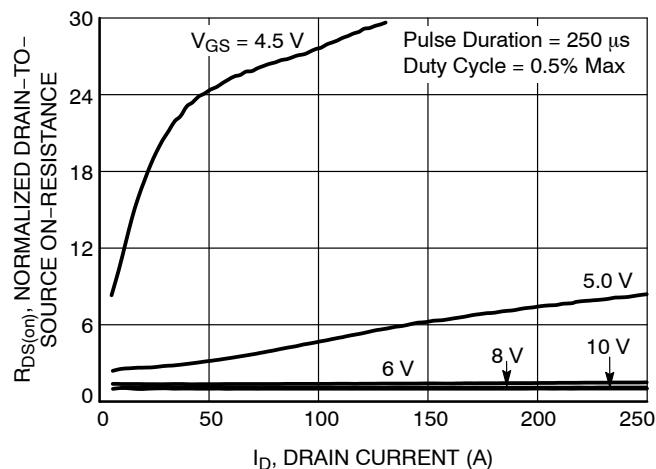


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

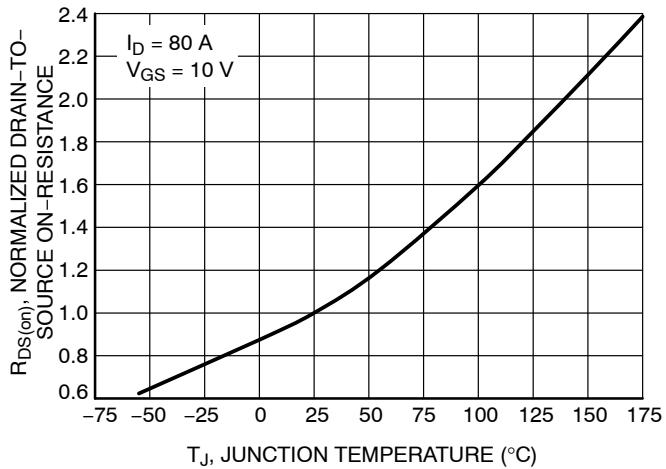


Figure 3. Normalized On-Resistance vs. Junction Temperature

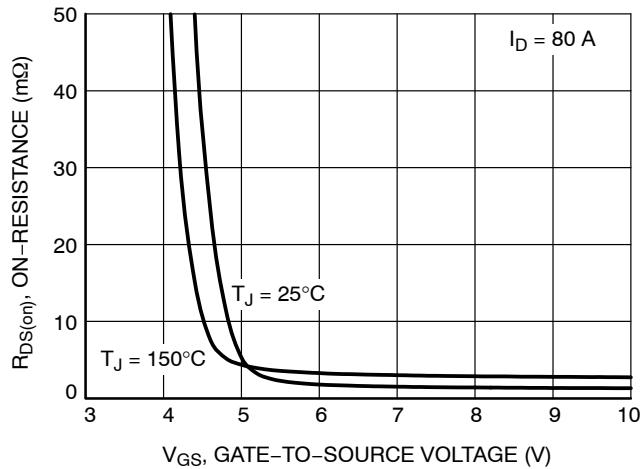


Figure 4. On-Resistance vs. Gate-to-Source Voltage

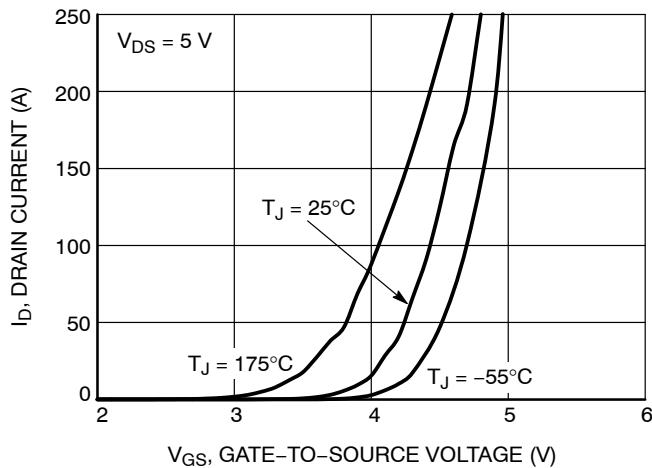


Figure 5. Transfer Characteristics

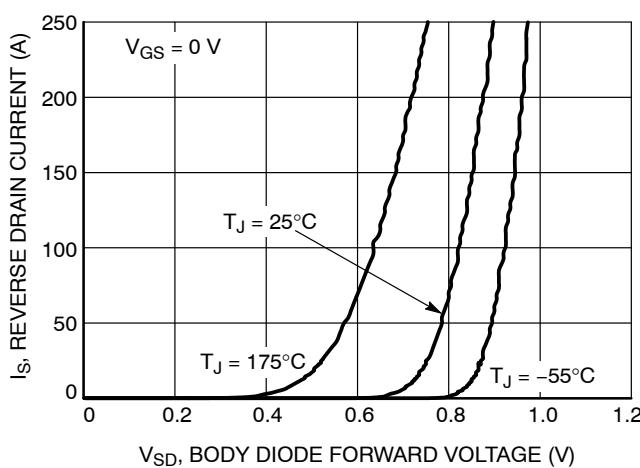


Figure 6. Source-to-Drain Diode Forward Voltage vs. Source Current

## TYPICAL CHARACTERISTICS

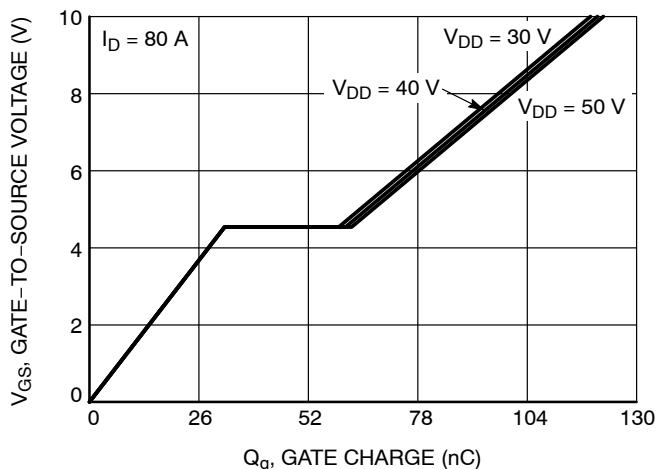


Figure 7. Gate Charge Characteristics

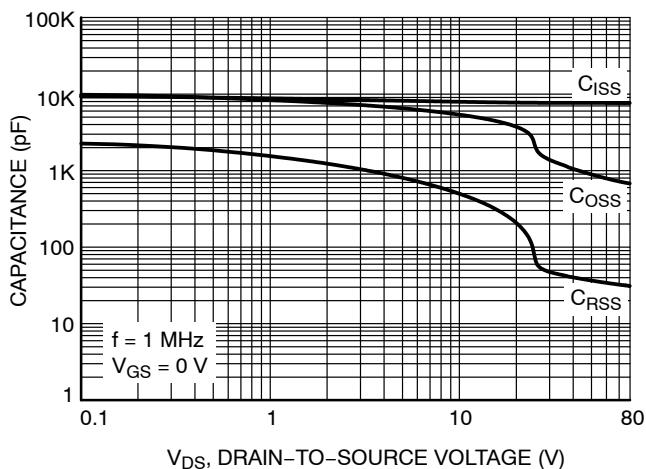


Figure 8. Capacitance vs. Drain-to-Source Voltage

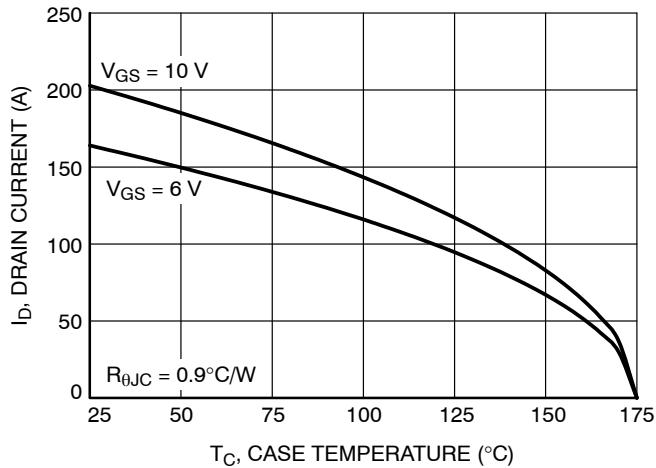


Figure 9. Drain Current vs. Case Temperature

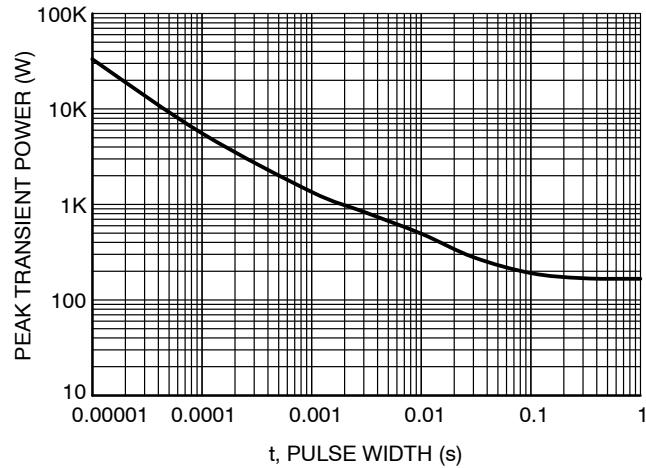


Figure 10. Peak Power

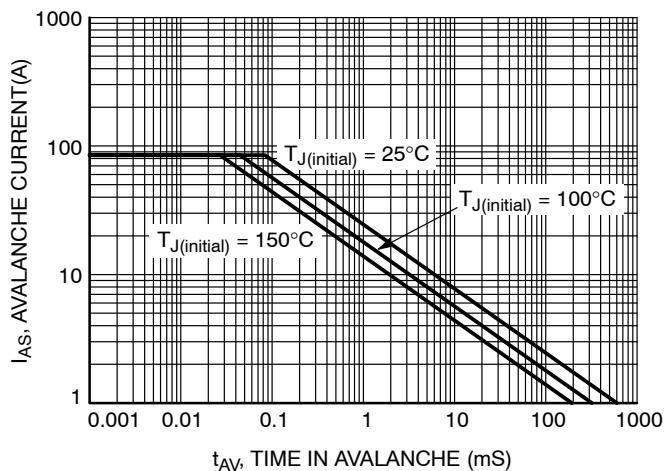


Figure 11. Unclamped Inductive Switching Capability

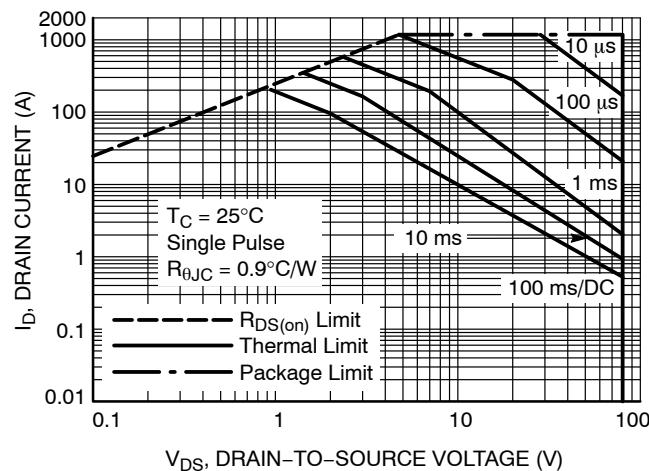


Figure 12. Forward Bias Safe Operating Area

## TYPICAL CHARACTERISTICS

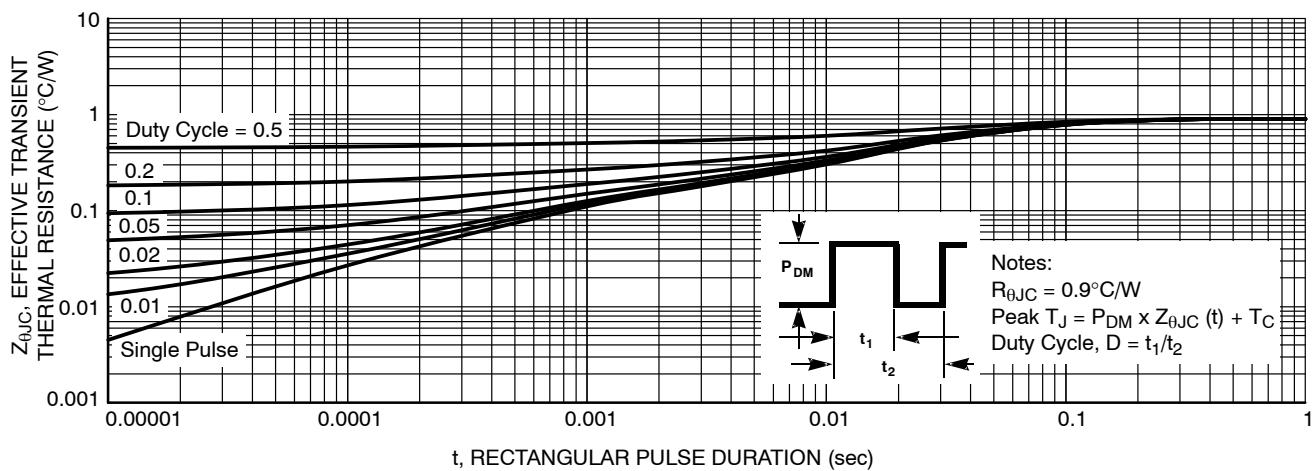


Figure 13. Transient Thermal Impedance

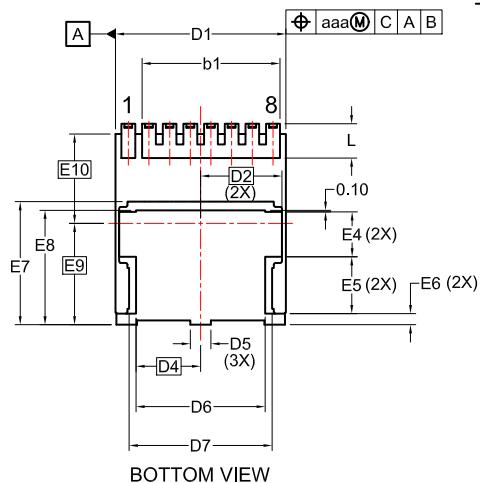
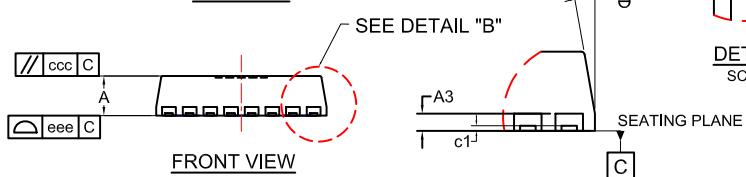
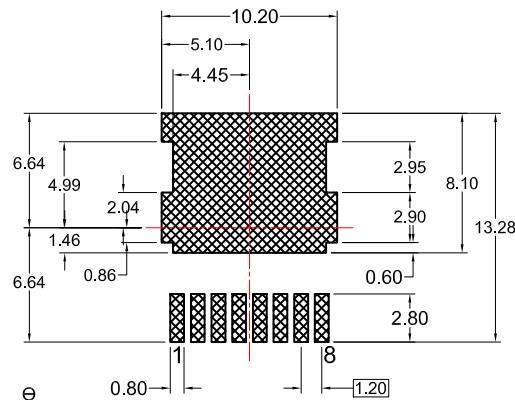
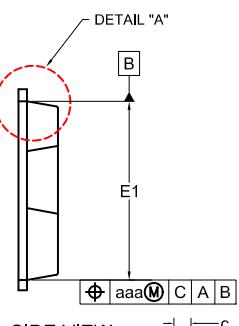
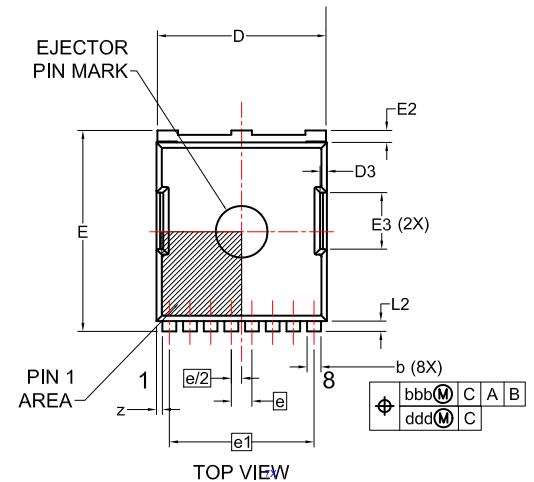
## DEVICE ORDERING INFORMATION

| Device       | Marking | Package              | Shipping <sup>†</sup> |
|--------------|---------|----------------------|-----------------------|
| NTBLS1D7N08H | 1D7N08H | M0-299A<br>(Pb-Free) | 2000 / 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.

## PACKAGE DIMENSIONS

## H-PSOF8L 11.68x9.80

CASE 100CU  
ISSUE A

\*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SODERRM/D.

## NOTES:

1. PACKAGE STANDARD REFERENCE: JEDEC MO-299, ISSUE A.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
3. CONTROLLING DIMENSION: MILLIMETERS.
4. COPLANARITY APPLIES TO THE EXPOSED 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.

| DIM | MILLIMETERS |       |       |
|-----|-------------|-------|-------|
|     | MIN.        | NOM.  | MAX.  |
| A   | 2.20        | 2.30  | 2.40  |
| A3  | 0.40        | 0.50  | 0.60  |
| b   | 0.70        | 0.80  | 0.90  |
| b1  | 8.00 REF    |       |       |
| c   | 0.40        | 0.50  | 0.60  |
| c1  | 0.10        | --    | --    |
| D   | 9.70        | 9.80  | 9.90  |
| D1  | 9.80        | 9.90  | 10.00 |
| D2  | 4.73 BSC    |       |       |
| D3  | 0.40 REF    |       |       |
| D4  | 3.75 BSC    |       |       |
| D5  | --          | 1.20  | --    |
| D6  | 7.40        | 7.50  | 7.60  |
| D7  | (8.30)      |       |       |
| E   | 11.58       | 11.68 | 11.78 |
| E1  | 10.28       | 10.38 | 10.48 |
| E2  | 0.60        | 0.70  | 0.80  |
| E3  | 3.30 REF    |       |       |
| E4  | --          | 2.60  | --    |
| E5  | --          | 3.30  | --    |
| E6  | --          | 0.65  | --    |
| E7  | 7.15 REF    |       |       |
| E8  | 6.55        | 6.65  | 6.75  |
| E9  | 5.89 BSC    |       |       |
| E10 | 5.19 BSC    |       |       |

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| e   | 1.20 BSC    |      |      |
| e/2 | 0.60 BSC    |      |      |
| e1  | 8.40 BSC    |      |      |
| K   | 1.50        | 1.57 | 1.70 |
| L   | 1.90        | 2.00 | 2.10 |
| L2  | 0.50        | 0.60 | 0.70 |
| z   | 0.35 REF    |      |      |
| θ   | 0°          | --   | 12°  |
| aaa | 0.20        |      |      |
| bbb | 0.25        |      |      |
| ccc | 0.20        |      |      |
| ddd | 0.20        |      |      |
| eee | 0.10        |      |      |
| E5  | --          | 3.30 | --   |
| E6  | --          | 0.65 | --   |
| E7  | 7.15 REF    |      |      |
| E8  | 6.55        | 6.65 | 6.75 |
| E9  | 5.89 BSC    |      |      |
| E10 | 5.19 BSC    |      |      |

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