

MOSFET - Power, Single N-Channel, Source Down Dual Cool® 33, WDFN9 25 V, 0.58 mΩ, 310 A

NTTFSSCH0D7N02X

Features

- Excellent Thermal Conduction by Advanced Source-Down Center Gate Dual-Cooling Package Technology (3.3 x 3.3 mm)
- Ultra Low $R_{DS(on)}$ to Improve System Efficiency
- Low Q_G and Capacitance to Minimize Driving and Switching Losses
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

- High Switching Frequency DC-DC Conversion
- Synchronous Rectifier

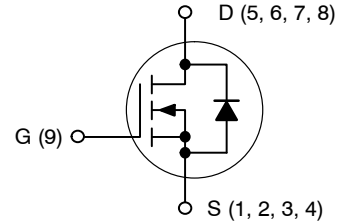
MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|-------------------------------------------------------------------|-------------------------------------------------------|---------------------------|------------------|
| Drain-to-Source Voltage | V_{DSS} | 25 | V |
| Gate-to-Source Voltage | V_{GS} | -12/+16 | V |
| Continuous Drain Current | $T_C = 25^\circ\text{C}$ | I_D | 310 |
| | | $T_C = 100^\circ\text{C}$ | 196 |
| Power Dissipation | $T_C = 25^\circ\text{C}$ | P_D | 87 W |
| Pulsed Drain Current | $T_C = 25^\circ\text{C}$, $t_p = 100 \mu\text{s}$ | I_{DM} | 1342 A |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |
| Source Current (Body Diode) | I_S | 146 | A |
| Single Pulse Avalanche Energy ($I_{PK} = 62 \text{ A}$) | E_{AS} | 192 | mJ |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | T_L | 260 | $^\circ\text{C}$ |

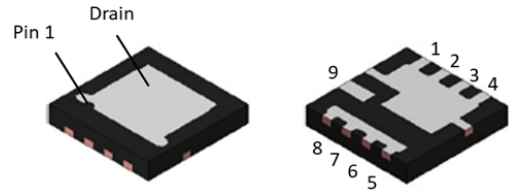
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are valid for the particular conditions noted.
2. Surface-mounted on FR4 board using a 1 in² pad size, 1 oz Cu pad.
3. E_{AS} of 192 mJ is based on started $T_J = 25^\circ\text{C}$, $I_{AS} = 62 \text{ A}$, $V_{GS} = 10 \text{ V}$, 100% avalanche tested.

| $V_{(BR)DSS}$ | $R_{DS(on)} \text{ MAX}$ | $I_D \text{ MAX}$ |
|---------------|------------------------------------|-------------------|
| 25 V | 0.58 mΩ @ $V_{GS} = 10 \text{ V}$ | 310 A |
| | 0.80 mΩ @ $V_{GS} = 4.5 \text{ V}$ | |

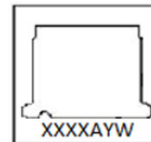


N-CHANNEL MOSFET



WDFN9
CASE 511BX

MARKING DIAGRAM



- 0D7 = Specific Device Code
- A = Assembly Location
- Y = Year
- W = Work Week

ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

NTTFSSCH0D7N02X

THERMAL CHARACTERISTICS

| Parameter | Symbol | Value | Unit |
|-----------------------------------------------|------------------|-------|------|
| Thermal Resistance, Junction-to-Case (Bottom) | $R_{\theta JCB}$ | 1.4 | °C/W |
| Thermal Resistance, Junction-to-Case (Top) | $R_{\theta JCT}$ | 1.2 | |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 60 | |

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 | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$ | 25 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $\Delta V_{(BR)DSS} / \Delta T_J$ | $I_D = 1\text{ mA}$, Referenced to 25°C | | 21 | | mV/°C |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 25\text{ V}$ | | | 10 | μA |
| | | $V_{DS} = 25\text{ V}, T_J = 125^\circ\text{C}$ | | | 100 | |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = +16\text{ V}$ | | | 100 | nA |

ON CHARACTERISTICS

| | | | | | | |
|------------------------------------------------|----------------------------------|-------------------------------------------------|-----|------|------|------------|
| Drain-to-Source On Resistance | $R_{DS(ON)}$ | $V_{GS} = 10\text{ V}, I_D = 24\text{ A}$ | | 0.51 | 0.58 | m Ω |
| | | $V_{GS} = 6\text{ V}, I_D = 19\text{ A}$ | | 0.56 | 0.65 | |
| | | $V_{GS} = 4.5\text{ V}, I_D = 19\text{ A}$ | | 0.66 | 0.80 | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = 484\text{ }\mu\text{A}$ | 1.1 | | 2.0 | V |
| Gate Threshold Voltage Temperature Coefficient | $\Delta V_{GS(TH)} / \Delta T_J$ | $V_{GS} = V_{DS}, I_D = 484\text{ }\mu\text{A}$ | | -3 | | mV/°C |
| Forward Transconductance | g_{FS} | $V_{DS} = 5\text{ V}, I_D = 24\text{ A}$ | | 190 | | S |

CHARGES, CAPACITANCES & GATE RESISTANCE

| | | | | | | |
|------------------------------|--------------|------------------------------------------------------------------|--|------|--|----------|
| Input Capacitance | C_{ISS} | $V_{GS} = 0\text{ V}, V_{DS} = 12\text{ V}, f = 1\text{ MHz}$ | | 3980 | | pF |
| Output Capacitance | C_{OSS} | | | 1160 | | |
| Reverse Transfer Capacitance | C_{RSS} | | | 124 | | |
| Output Charge | Q_{OSS} | | | 22 | | nC |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DD} = 12\text{ V}; I_D = 24\text{ A}$ | | 25 | | |
| | | $V_{GS} = 6\text{ V}, V_{DD} = 12\text{ V}; I_D = 24\text{ A}$ | | 33 | | |
| | | $V_{GS} = 10\text{ V}, V_{DD} = 12\text{ V}; I_D = 24\text{ A}$ | | 55 | | |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 5.7 | | |
| Gate-to-Source Charge | Q_{GS} | | | 9.7 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 4.1 | | |
| Gate Plateau Voltage | V_{GP} | | | 2.5 | | |
| Gate Resistance | R_G | $f = 1\text{ MHz}$ | | 0.4 | | Ω |

SWITCHING CHARACTERISTICS

| | | | | | | |
|---------------------|--------------|--------------------------------------------------------------------------------------------------------------------|--|----|--|----|
| Turn-On Delay Time | $t_{d(ON)}$ | Resistive Load, $V_{GS} = 0/10\text{ V}, V_{DD} = 12\text{ V},$ $I_D = 24\text{ A}, R_G = 2.5\text{ }\Omega$ | | 4 | | ns |
| Rise Time | t_r | | | 6 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | 26 | | |
| Fall Time | t_f | | | 57 | | |

SOURCE-TO-DRAIN DIODE CHARACTERISTICS

| | | | | | | |
|-----------------------|----------|-------------------------------------------------------------------|--|------|-----|---|
| Forward Diode Voltage | V_{SD} | $V_{GS} = 0\text{ V}, I_S = 24\text{ A}$ | | 0.76 | 1.2 | V |
| | | $V_{GS} = 0\text{ V}, I_S = 24\text{ A}, T_J = 125^\circ\text{C}$ | | 0.63 | | |

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

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|----------------------------------------------|----------|-------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| SOURCE-TO-DRAIN DIODE CHARACTERISTICS | | | | | | |
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0\text{ V}, I_S = 24\text{ A},$ $di/dt = 700\text{ A}/\mu\text{s}, V_{DD} = 12\text{ V}$ | | 17 | | ns |
| Charge Time | t_a | | | 10 | | |
| Discharge Time | t_b | | | 7 | | |
| Reverse Recovery Charge | Q_{RR} | | | 58 | | 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.

TYPICAL CHARACTERISTICS

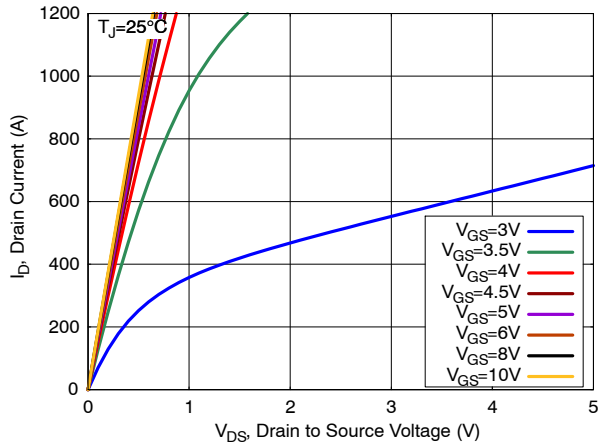


Figure 1. On-Region Characteristics

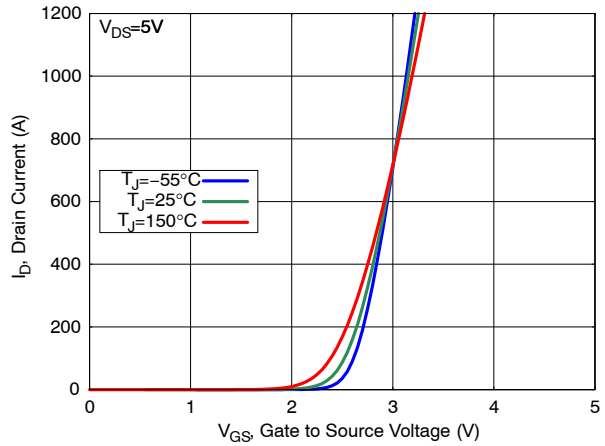


Figure 2. Transfer Characteristics

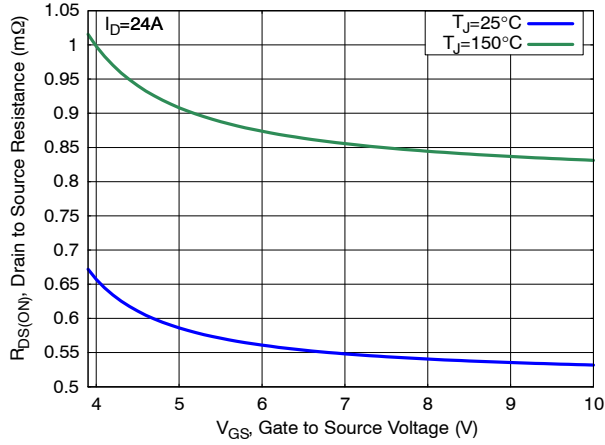


Figure 3. On-Resistance vs. Gate Voltage

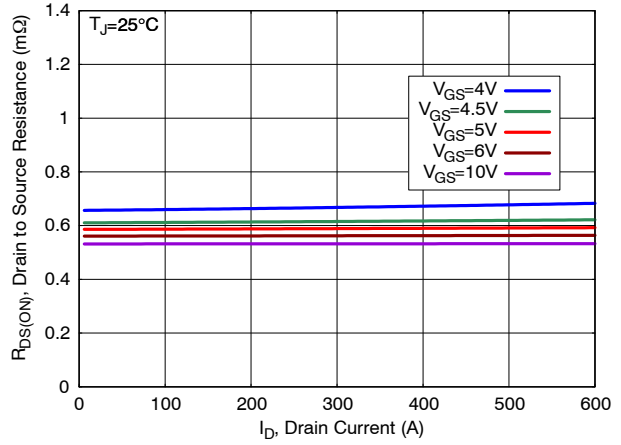


Figure 4. On-Resistance vs. Drain Current

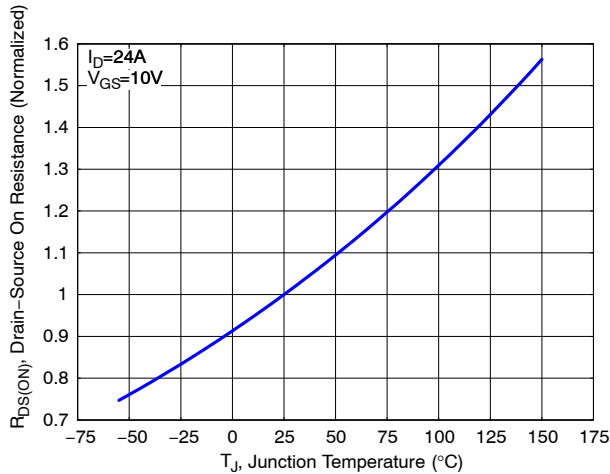


Figure 5. Normalized ON Resistance vs. Junction Temperature

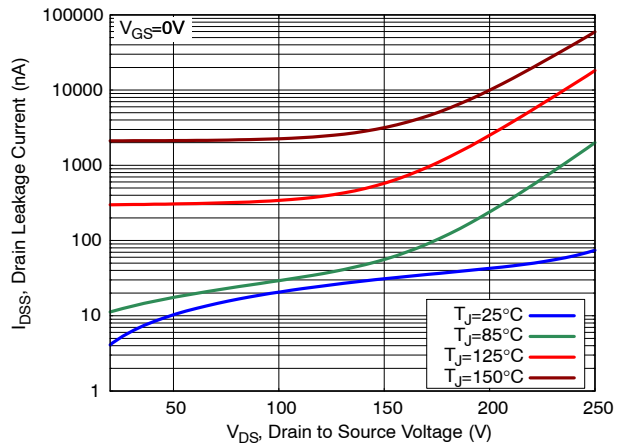


Figure 6. Drain Leakage Current vs. Drain Voltage

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TYPICAL CHARACTERISTICS

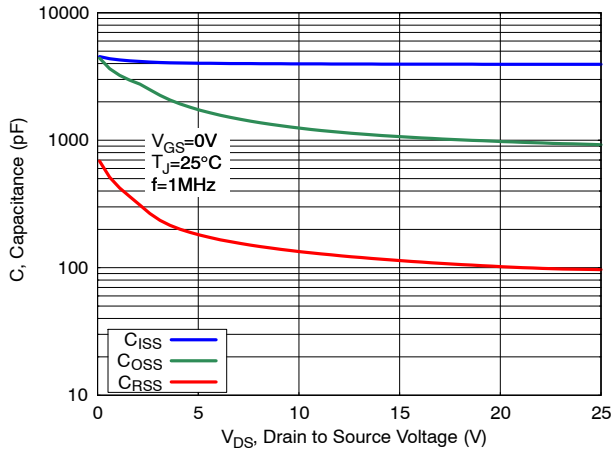


Figure 7. Capacitance Characteristics

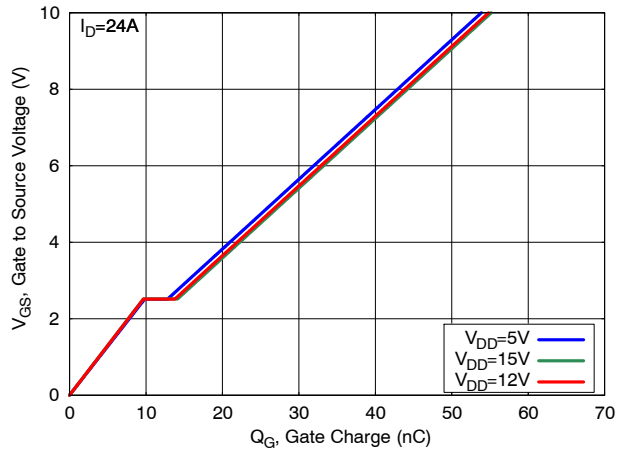


Figure 8. Gate Charge Characteristics

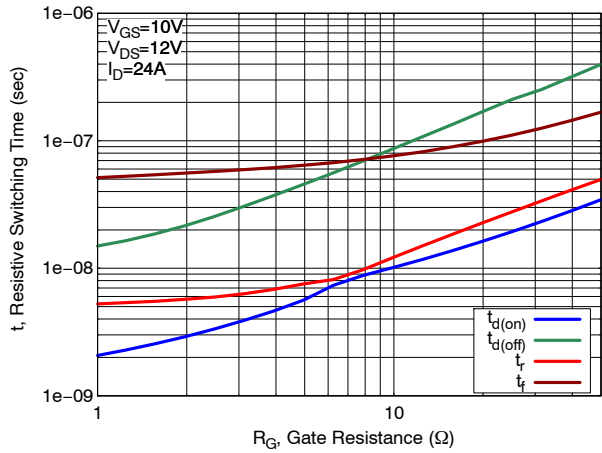


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

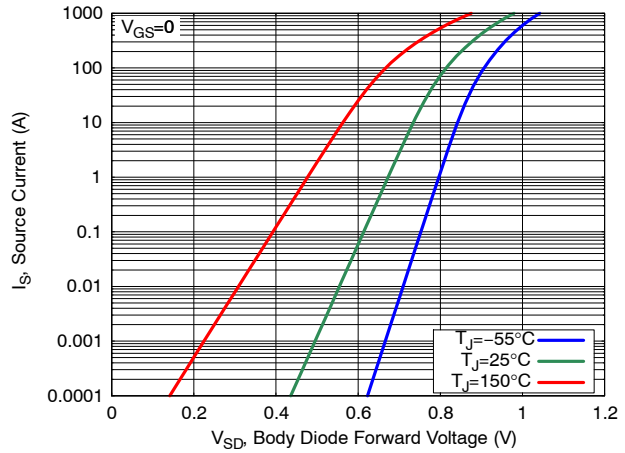


Figure 10. Diode Forward Characteristics

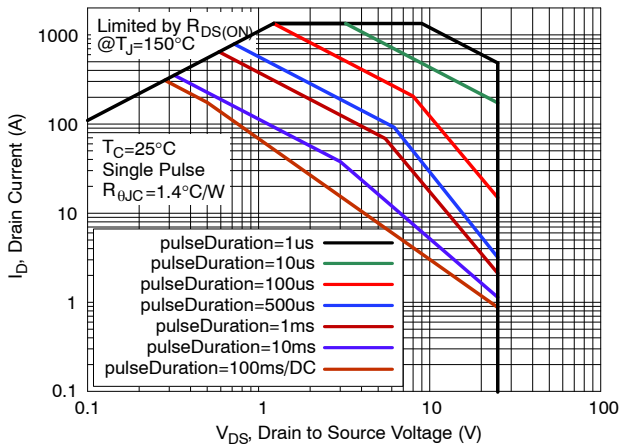


Figure 11. Safe Operating Area (SOA)

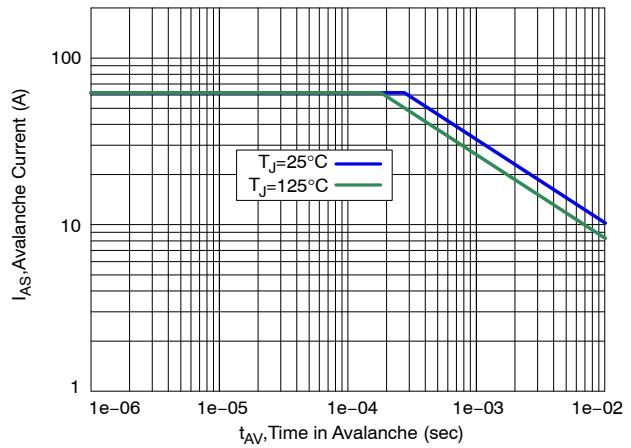


Figure 12. Avalanche Current vs. Pulse Time (UIS)

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TYPICAL CHARACTERISTICS

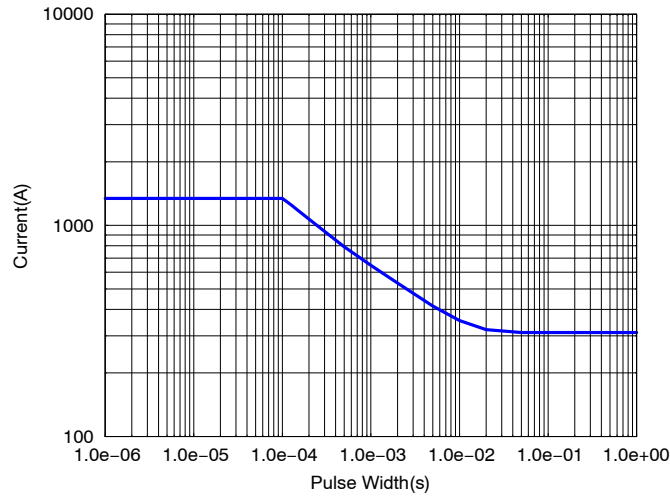


Figure 13. IDM vs. Pulse Width

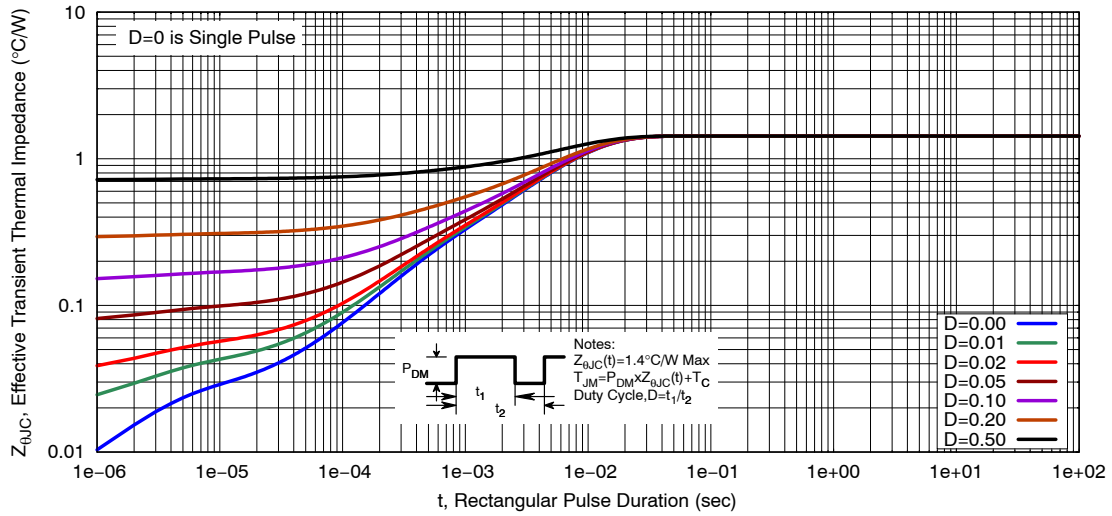


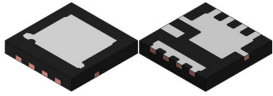
Figure 14. Transient Thermal Response

ORDERING INFORMATION

| Device | Marking | Package | Shipping† |
|-----------------|---------|--------------------|--------------------|
| NTTFSSCH0D7N02X | 0D7 | WDFN9 (Pb-Free) | 5000 / Tape & Reel |

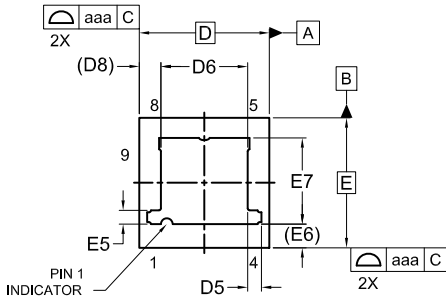
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).

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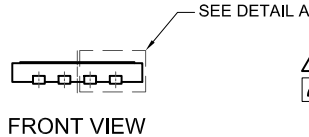


WDFN9 3.30x3.30x0.58, 0.65P
CASE 511BX
ISSUE B

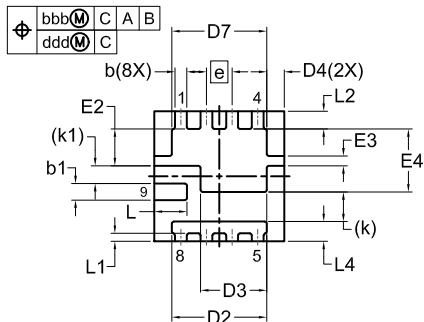
DATE 13 AUG 2024



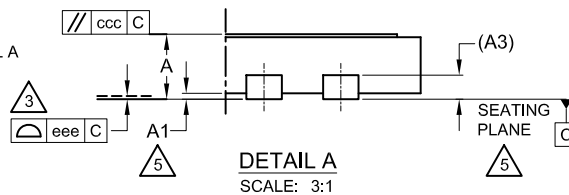
TOP VIEW



FRONT VIEW

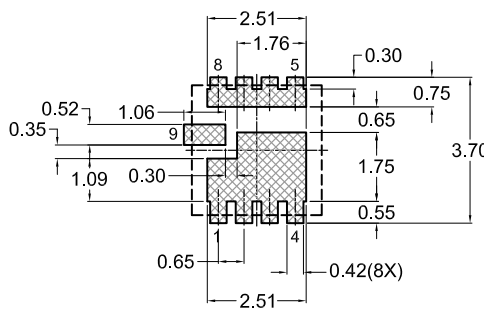


BOTTOM VIEW



DETAIL A

SCALE: 3:1



LAND PATTERN RECOMMENDATION

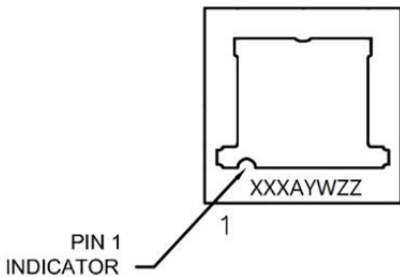
*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1, D2, E1 AND E2 DO NOT INCLUDE MOLD FLASH. 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.

| UNIT IN MILLIMETERS | | | |
|---------------------|----------|------|------|
| DIM | MIN | NOM | MAX |
| A | 0.53 | 0.58 | 0.63 |
| A1 | 0.00 | - | 0.05 |
| A3 | 0.20 REF | | |
| b | 0.25 | 0.30 | 0.35 |
| b1 | 0.37 | 0.42 | 0.47 |
| D | 3.30 BSC | | |
| D2 | 2.31 | 2.41 | 2.51 |
| D3 | 1.58 | 1.68 | 1.78 |
| D4 | 0.35 | 0.45 | 0.55 |
| D5 | 0.25 | 0.35 | 0.45 |
| D6 | 2.10 | 2.20 | 2.30 |
| D7 | 2.31 | 2.41 | 2.51 |
| D8 | 0.55 REF | | |
| e | 0.65 BSC | | |
| E | 3.30 BSC | | |
| E2 | 0.84 | 0.94 | 1.04 |
| E3 | 0.20 | 0.25 | 0.30 |
| E4 | 1.50 | 1.60 | 1.70 |
| E5 | 0.25 | 0.35 | 0.40 |
| E6 | 0.60 REF | | |
| E7 | 2.10 | 2.20 | 2.30 |
| k | 0.75 REF | | |
| k1 | 0.45 REF | | |
| L | 0.73 | 0.83 | 0.93 |
| L1 | 0.10 | 0.20 | 0.30 |
| L2 | 0.35 | 0.45 | 0.55 |
| L4 | 0.40 | 0.50 | 0.60 |
| aaa | 0.10 | | |
| bbb | 0.10 | | |
| ccc | 0.10 | | |
| ddd | 0.05 | | |
| eee | 0.08 | | |

GENERIC MARKING DIAGRAM*



- XXX = Specific Device Code
- A = Assembly Location
- Y = Year
- W = Work Week
- ZZ = Assembly Lot Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

| | | |
|-------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| DESCRIPTION: | WDFN9 3.30x3.30x0.58, 0.65P | PAGE 1 OF 1 |

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