

MOSFET - Power, Single N-Channel, Logic Level, SO-8FL

40 V, 0.49 mΩ, 455 A

NTMFS0D5N04XL

Features

- Low $R_{DS(on)}$ to Minimize Conduction Loss
- Low Q_{RR} with Soft Recovery to Minimize E_{RR} Loss and Voltage Spike
- Low Q_G and Capacitance to Minimize Driving and Switching Loss
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Typical Applications

- High Switching Frequency DC-DC Conversion
- Synchronous Rectification

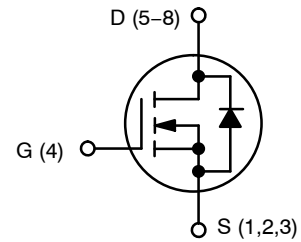
MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$ unless otherwise stated)

| Parameter | | Symbol | Value | Unit | |
|--|---|----------------|---------------------------|------------------|---|
| Drain-to-Source Voltage | | V_{DSS} | 40 | V | |
| Gate-to-Source Voltage | | V_{GS} | ± 20 | V | |
| Continuous Drain Current $R_{\theta JC}$ (Note 2) | Steady State | I_D | $T_C = 25^\circ\text{C}$ | 455 | A |
| | | | $T_C = 100^\circ\text{C}$ | 322 | |
| Power Dissipation $R_{\theta JC}$ (Note 2) | Steady State | P_D | $T_C = 25^\circ\text{C}$ | 194 | W |
| | | | $T_C = 100^\circ\text{C}$ | 97.3 | |
| Pulsed Drain Current | $T_A = 25^\circ\text{C}, t_p = 100 \mu\text{s}$ | I_{DM} | 2474 | A | |
| Pulsed Sourced Current (Body Diode) | | I_{SM} | 2474 | | |
| Operating Junction and Storage Temperature Range | | T_J, T_{STG} | -55 to +175 | $^\circ\text{C}$ | |
| Source Current (Body Diode) | | I_S | 306 | A | |
| Single Pulse Drain-to-Source Avalanche Energy ($I_{Lpk} = 94 \text{ A}$) | | E_{AS} | 1325 | mJ | |
| Lead Temperature Soldering Reflow for Soldering Purposes (1/8" from case for 10 s) | | T_L | 260 | $^\circ\text{C}$ | |

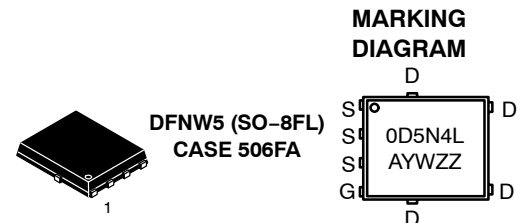
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Surface-mounted on FR4 board using 1 in² pad size, 1 oz Cu pad.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
3. $R_{\theta JCT}$ Thermal Resistance - Junction to Case Top = 20 $^\circ\text{C}/\text{W}$.

| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ MAX}$ | $I_D \text{ MAX}$ |
|---------------|--------------------------|-------------------|
| 40 V | 0.49 mΩ @ 10 V | 455 A |
| | 0.78 mΩ @ 4.5 V | |



N-CHANNEL MOSFET



0D5N4L = Specific Device Code
 A = Assembly Location
 Y = Year
 W = 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.

NTMFS0D5N04XL

THEMAL CHARACTERISTICS

| Parameter | Symbol | Value | Unit |
|---|-----------------|-------|------|
| Thermal Resistance, Junction-to-Case – Steady State (Note 2) | $R_{\theta JC}$ | 0.77 | °C/W |
| Thermal Resistance, Junction-to-Ambient – Steady State (Note 2) | $R_{\theta JA}$ | 38 | |

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

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|-----------------------------------|--|---------------------------|------|-----|---------------|
| OFF CHARACTERISTICS | | | | | | |
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$ | 40 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $\Delta V_{(BR)DSS} / \Delta T_J$ | $I_D = 1\text{ mA}$, referenced to 25°C | | 16.5 | | mV/°C |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0\text{ V}, V_{DS} = 40\text{ V}$ | $T_J = 25^\circ\text{C}$ | | 10 | μA |
| | | | $T_J = 125^\circ\text{C}$ | | 100 | |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$ | | | 100 | nA |

ON CHARACTERISTICS

| | | | | | | |
|--|----------------------------------|---|-----|-------|------|------------|
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 50\text{ A}, T_J = 25^\circ\text{C}$ | | 0.39 | 0.49 | m Ω |
| | | $V_{GS} = 4.5\text{ V}, I_D = 50\text{ A}, T_J = 25^\circ\text{C}$ | | 0.54 | 0.78 | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = 330\text{ }\mu\text{A}, T_J = 25^\circ\text{C}$ | 1.3 | | 2.2 | V |
| Gate Threshold Voltage Temperature Coefficient | $\Delta V_{GS(TH)} / \Delta T_J$ | $V_{GS} = V_{DS}, I_D = 330\text{ }\mu\text{A}$ | | -5.35 | | mV/°C |
| Forward Transconductance | g_{FS} | $V_{DS} = 5\text{ V}, I_D = 50\text{ A}$ | | 277 | | S |

CHARGES, CAPACITANCES & GATE RESISTANCE

| | | | | | | |
|------------------------------|--------------|--|--|------|--|----|
| Input Capacitance | C_{ISS} | $V_{GS} = 0\text{ V}, V_{DS} = 20\text{ V}, f = 1\text{ MHz}$ | | 9444 | | pF |
| Output Capacitance | C_{OSS} | | | 2468 | | |
| Reverse Transfer Capacitance | C_{RSS} | | | 38 | | |
| Output Charge | Q_{OSS} | $V_{GS} = 0\text{ V}, V_{DS} = 20\text{ V}$ | | 95 | | nC |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 20\text{ V}; I_D = 50\text{ A}$ | | 57 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 20\text{ V}; I_D = 50\text{ A}$ | | 127 | | |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 15 | | |
| Gate-to-Source Charge | Q_{GS} | | | 27 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 9 | | |
| Gate Plateau Voltage | V_{GP} | | | 2.8 | | |
| Gate Resistance | R_G | $f = 1\text{ MHz}$ | | 0.48 | | |

SWITCHING CHARACTERISTICS (Note 4)

| | | | | | | |
|---------------------|--------------|--|--|----|--|----|
| Turn-On Delay Time | $t_{d(ON)}$ | Resistive Load, $V_{GS} = 0/10\text{ V}, V_{DS} = 20\text{ V},$ $I_D = 50\text{ A}, R_G = 2.5\text{ }\Omega$ | | 11 | | ns |
| Rise Time | t_r | | | 10 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | 55 | | |
| Fall Time | t_f | | | 24 | | |

DIODE CHARACTERISTICS

| | | | | | | | |
|-------------------------|----------|---|---------------------------|------|------|-----|----|
| Forward Diode Voltage | V_{SD} | $V_{GS} = 0\text{ V}, I_S = 50\text{ A}$ | $T_J = 25^\circ\text{C}$ | | 0.78 | 1.2 | V |
| | | | $T_J = 125^\circ\text{C}$ | | 0.63 | | |
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0\text{ V}, V_{DS} = 20\text{ V},$ $di_S/dt = 300\text{ A}/\mu\text{s}, I_S = 50\text{ A}$ | | 40.5 | | ns | |
| Charge Time | t_a | | | 22.2 | | | |
| Discharge Time | t_b | | | 18.3 | | | |
| Reverse Recovery Charge | Q_{RR} | | | 108 | | | 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.

NTMFS0D5N04XL

TYPICAL CHARACTERISTICS

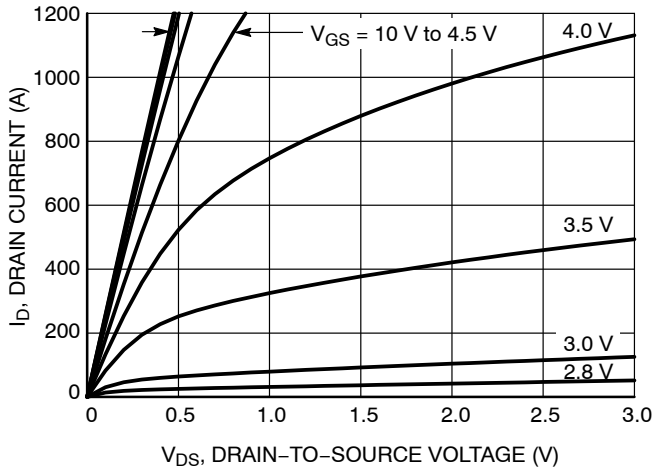


Figure 1. On-Region Characteristics

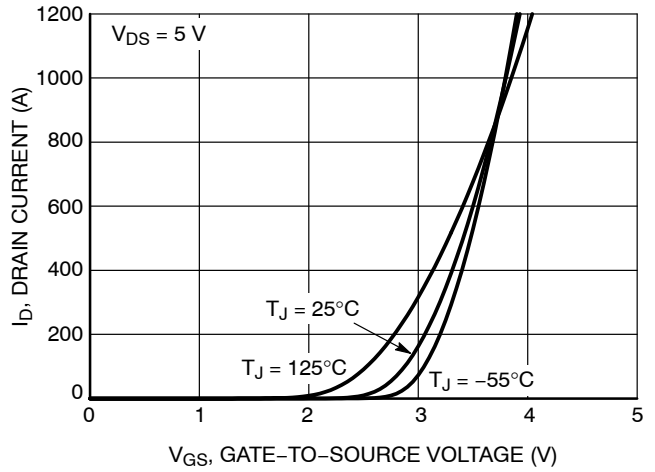


Figure 2. Transfer Characteristics

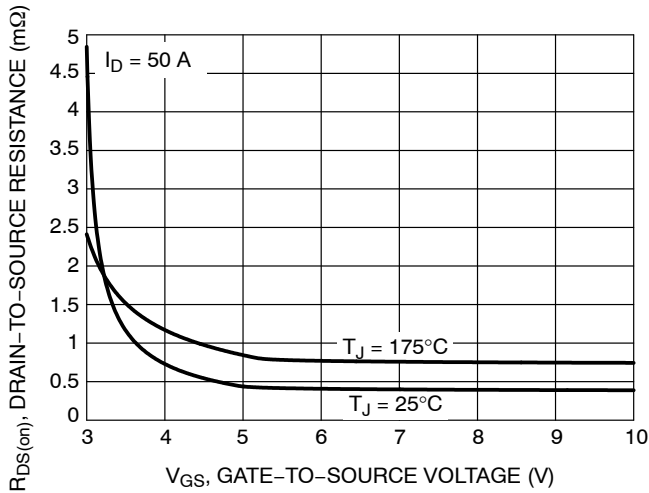


Figure 3. On-Resistance vs. Gate-to-Source Voltage

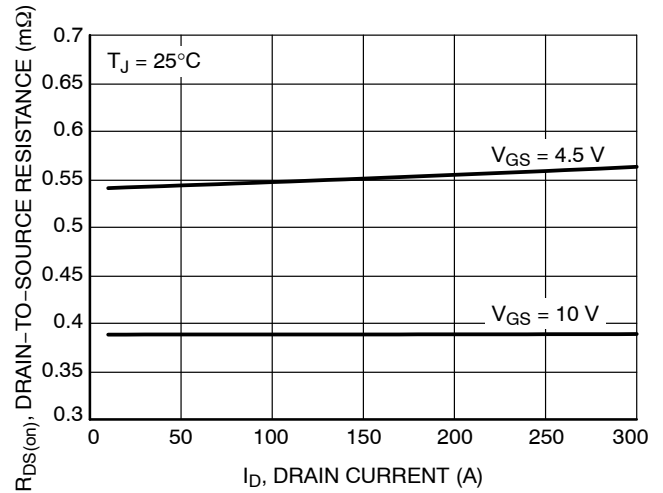


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

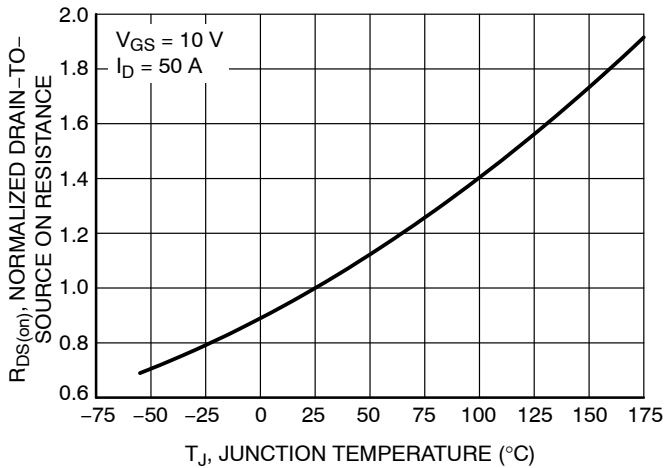


Figure 5. On-Resistance Variation with Temperature

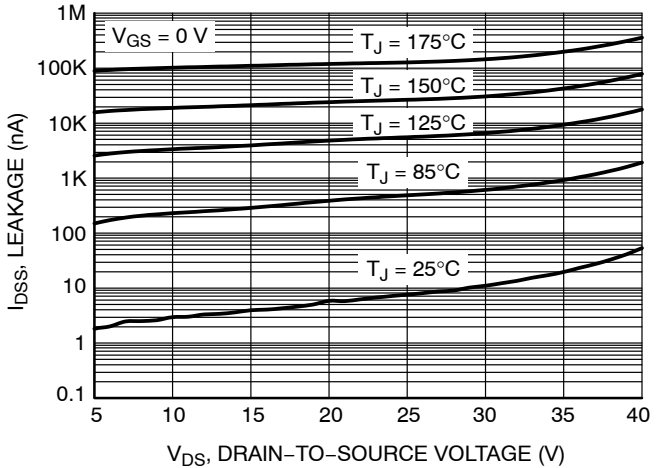


Figure 6. Drain-to-Source Leakage Current vs. Voltage

NTMFS0D5N04XL

TYPICAL CHARACTERISTICS

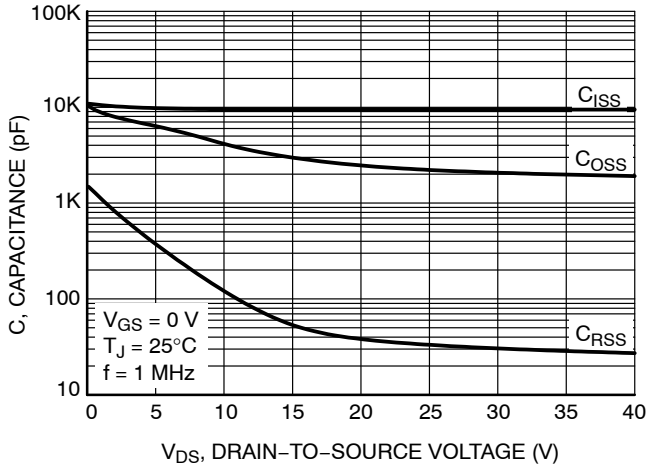


Figure 7. Capacitance Variation

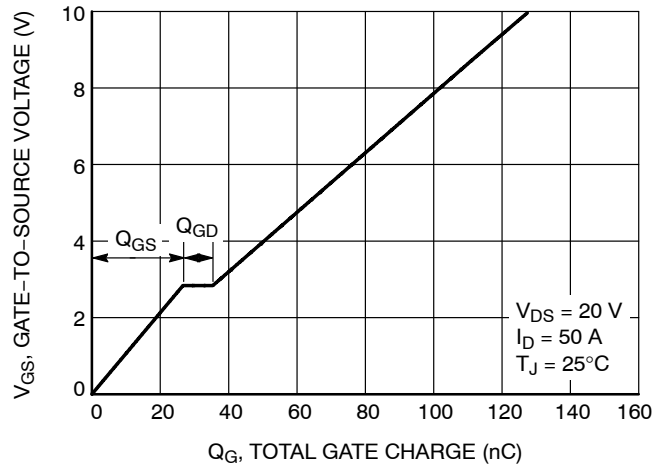


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

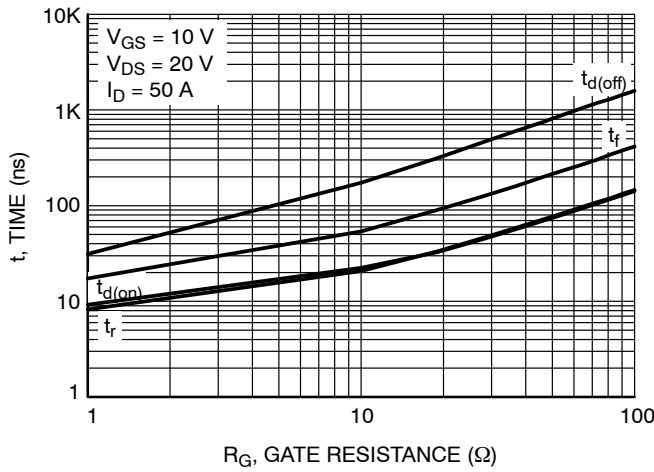


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

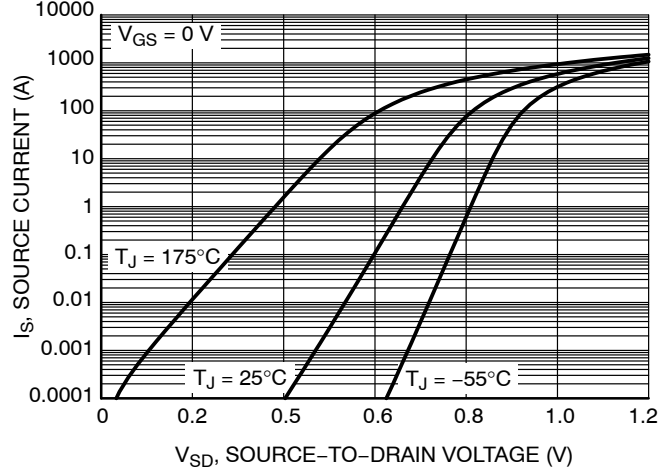


Figure 10. Diode Forward Voltage vs. Current

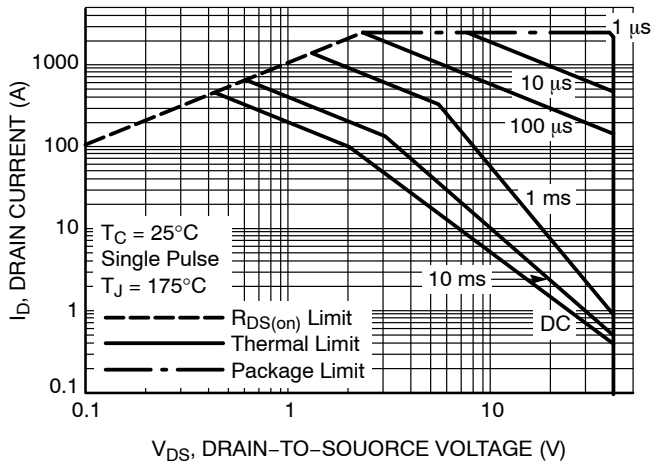


Figure 11. Safe Operating Area (SOA)

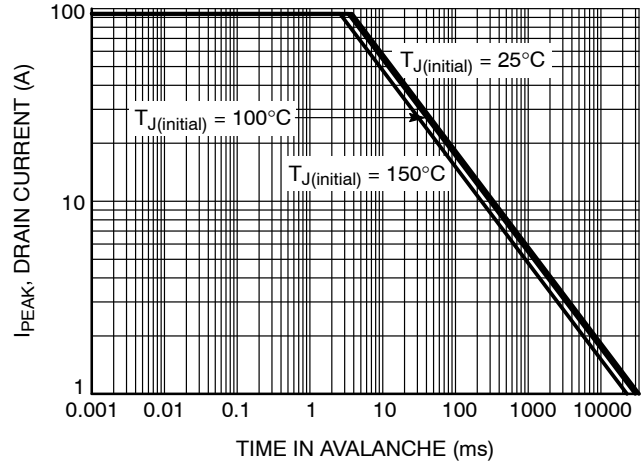


Figure 12. Avalanche Current vs. Pulse Time (UIS)

NTMFS0D5N04XL

TYPICAL CHARACTERISTICS

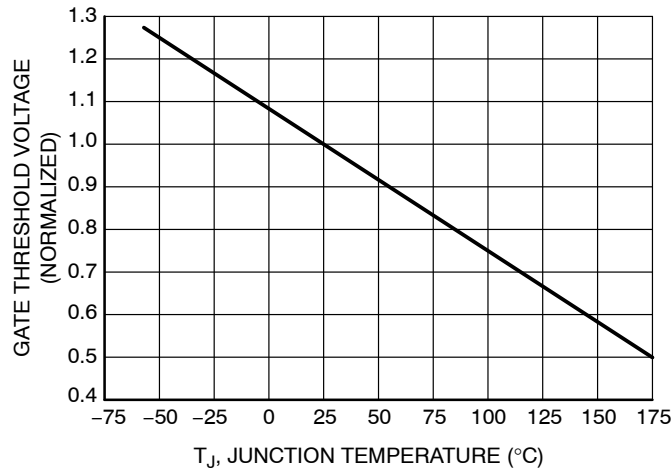


Figure 13. Gate Threshold Voltage vs. Junction Temperature

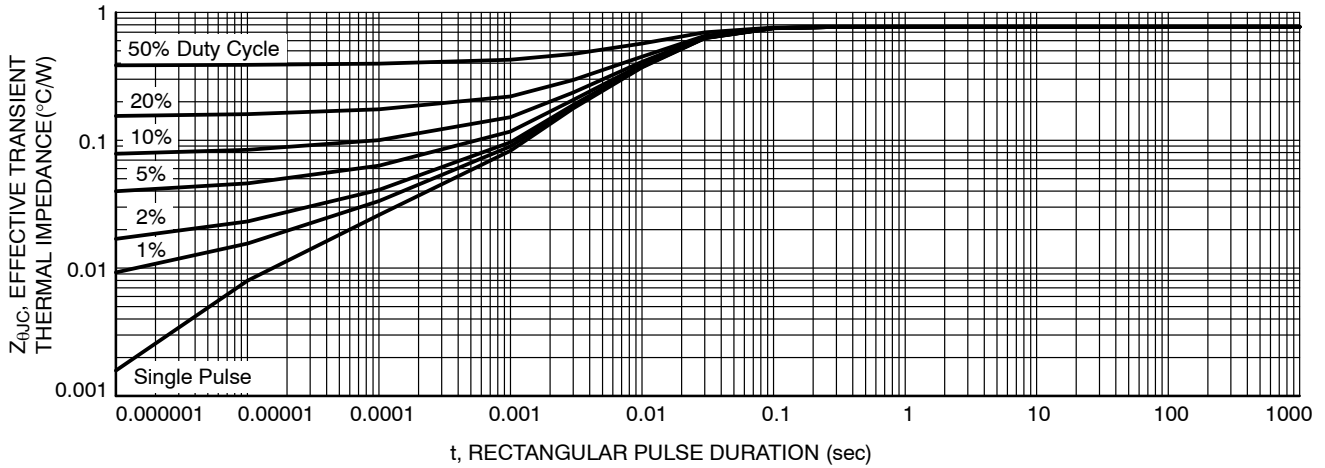


Figure 14. Thermal Characteristics

DEVICE ORDERING INFORMATION

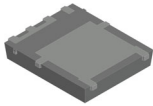
| Device | Marking | Package | Shipping† |
|------------------|---------|--------------------|--------------------|
| NTMFS0D5N04XLT1G | 0D5N4L | DFNW5 (Pb-Free) | 1500 / Tape & Reel |

†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.

MECHANICAL CASE OUTLINE

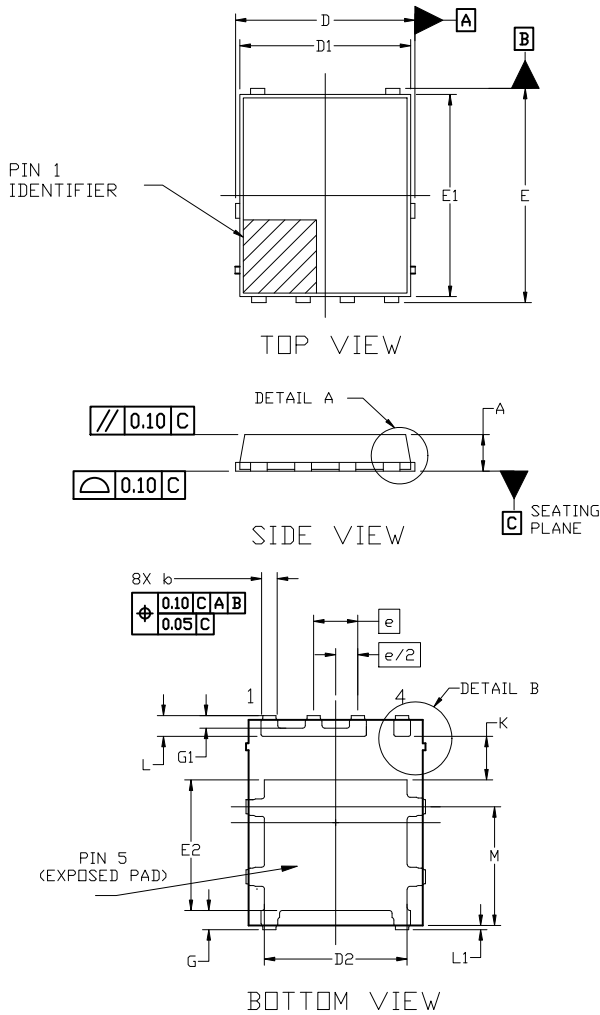
PACKAGE DIMENSIONS

ON Semiconductor®



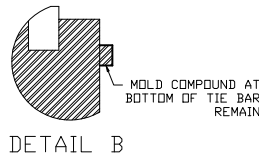
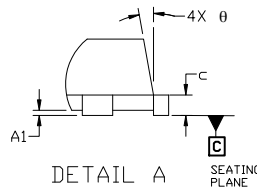
DFN5 5x6, 1.27P
CASE 506FA
ISSUE O

DATE 16 FEB 2021

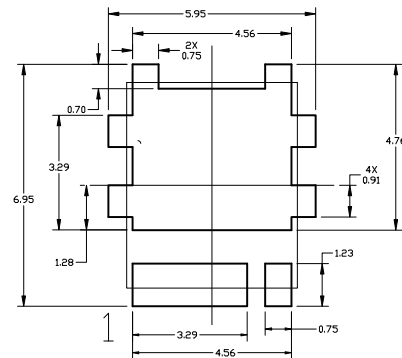


NOTES:

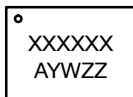
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.



| MILLIMETERS | | | |
|-------------|-----------|------|------|
| DIM | MIN. | NOM. | MAX. |
| A | 0.90 | 1.00 | 1.10 |
| A1 | 0.00 | --- | 0.05 |
| b | 0.33 | 0.41 | 0.51 |
| c | 0.23 | 0.28 | 0.33 |
| D | 5.00 | 5.15 | 5.30 |
| D1 | 4.80 | 5.00 | 5.20 |
| D2 | 3.90 | 4.10 | 4.30 |
| E | 6.00 | 6.15 | 6.30 |
| E1 | 5.70 | 5.90 | 6.10 |
| E2 | 3.55 | 3.75 | 3.95 |
| e | 1.27 BSC | | |
| G | 0.50 | 0.55 | 0.70 |
| G1 | 0.26 | 0.36 | 0.46 |
| k | 1.10 | 1.25 | 1.40 |
| L | 0.50 | 0.60 | 0.70 |
| L1 | 0.150 REF | | |
| M | 3.00 | 3.40 | 3.80 |
| θ | 0° | --- | 12° |



GENERIC MARKING DIAGRAM*



- XXXX = 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.

* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

| | | |
|-------------------------|------------------------|--|
| DOCUMENT NUMBER: | 98AON21323H | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION: | DFN5 5x6, 1.27P | PAGE 1 OF 1 |

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Email Requests to: orderlit@onsemi.com

onsemi Website: www.onsemi.com

TECHNICAL SUPPORT

North American Technical Support:

Voice Mail: 1 800-282-9855 Toll Free USA/Canada

Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative