

MOSFET - Power, Single N-Channel, SO8-FL

40 V, 0.52 mΩ, 414 A

NTMFS0D5N04XM

Features

- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Small Footprint (5 x 6 mm) with Compact Design
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

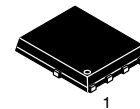
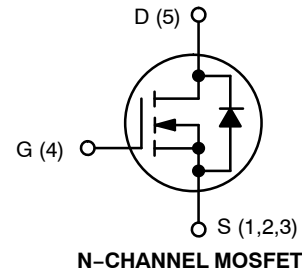
- Motor Drive
- Battery Protection
- Orings

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

| Parameter | | Symbol | Value | Unit |
|--|--|-----------------------------------|-------------|------|
| Drain-to-Source Voltage | | V _{DSS} | 40 | V |
| Gate-to-Source Voltage | | V _{GS} | ±20 | V |
| Continuous Drain Current | T _C = 25°C | I _D | 414 | A |
| | T _C = 100°C | | 293 | |
| Power Dissipation | T _C = 25°C | P _D | 163 | W |
| Pulsed Drain Current | T _C = 25°C, t _p = 10 μs | I _{DM} | 3152 | A |
| Operating Junction and Storage Temperature Range | | T _J , T _{STG} | −55 to +175 | °C |
| Source Current (Body Diode) | | I _S | 251 | A |
| Single Pulse Avalanche Energy | I _{PK} = 28.2 A | E _{AS} | 1434 | mJ |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | | T _L | 260 | °C |

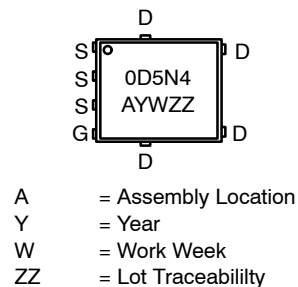
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

| $V_{(BR)DSS}$ | $R_{DS(on)} \text{ MAX}$ | $I_D \text{ MAX}$ |
|---------------|--------------------------|-------------------|
| 40 V | 0.52 mΩ @ 10 V | 414 A |



DFN5 (SO-8FL)
CASE 506FA

MARKING DIAGRAM



ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 5 of this data sheet.

NTMFS0D5N04XM

THERMAL CHARACTERISTICS

| Parameter | Symbol | Value | Unit |
|--|-----------------|-------|------|
| Thermal Resistance, Junction-to-Case (Note 2) | $R_{\theta JC}$ | 0.92 | °C/W |
| Thermal Resistance, Junction-to-Ambient (Notes 1, 2) | $R_{\theta JA}$ | 38.9 | |

- Surface-mounted on FR4 board using 650 mm² pad, 2 oz Cu pad.
- The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

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 | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 1\text{ mA}, T_J = 25^\circ\text{C}$ | 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 | | 15 | | mV/°C |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 40\text{ V}, T_J = 25^\circ\text{C}$ | | | 10 | μA |
| | | $V_{DS} = 40\text{ V}, T_J = 125^\circ\text{C}$ | | | 100 | |
| 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 | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 50\text{ A}, T_J = 25^\circ\text{C}$ | | 0.43 | 0.52 | m Ω |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = 240\text{ }\mu\text{A}, T_J = 25^\circ\text{C}$ | 2.5 | 3.0 | 3.5 | V |
| Gate Threshold Voltage Temperature Coefficient | $\Delta V_{GS(TH)} / \Delta T_J$ | $V_{GS} = V_{DS}, I_D = 240\text{ }\mu\text{A}$ | | -7.21 | | mV/°C |
| Forward Trans-conductance | g_{FS} | $V_{DS} = 5\text{ V}, I_D = 50\text{ A}$ | | 267 | | S |

CHARGES, CAPACITANCES & GATE RESISTANCE

| | | | | | | |
|------------------------------|--------------|---|--|------|--|----------|
| Input Capacitance | C_{ISS} | $V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | | 6267 | | pF |
| Output Capacitance | C_{OSS} | | | 4454 | | |
| Reverse Transfer Capacitance | C_{RSS} | | | 89.3 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{DD} = 20\text{ V}, I_D = 50\text{ A}, V_{GS} = 10\text{ V}$ | | 97.5 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 18.4 | | |
| Gate-to-Source Charge | Q_{GS} | | | 27.5 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 17.8 | | |
| Gate Resistance | R_G | $f = 1\text{ MHz}$ | | 0.68 | | Ω |

SWITCHING CHARACTERISTICS

| | | | | | | |
|---------------------|--------------|--|--|------|--|----|
| Turn-On Delay Time | $t_{d(ON)}$ | Resistive Load, $V_{GS} = 0/10\text{ V}$, $V_{DD} = 20\text{ V}, I_D = 50\text{ A}, R_G = 0\text{ }\Omega$ | | 30 | | ns |
| Rise Time | t_r | | | 9.73 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | 46.1 | | |
| Fall Time | t_f | | | 7.91 | | |

SOURCE-TO-DRAIN DIODE CHARACTERISTICS

| | | | | | | |
|-------------------------|----------|--|--|------|-----|----|
| Forward Diode Voltage | V_{SD} | $I_S = 50\text{ A}, V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$ | | 0.8 | 1.2 | V |
| | | $I_S = 50\text{ A}, V_{GS} = 0\text{ V}, T_J = 125^\circ\text{C}$ | | 0.65 | | |
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0\text{ V}, I_S = 50\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}, V_{DD} = 20\text{ V}$ | | 80.4 | | ns |
| Charge Time | t_a | | | 45.7 | | |
| Discharge Time | t_b | | | 34.6 | | |
| Reverse Recovery Charge | Q_{RR} | | | 206 | | 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

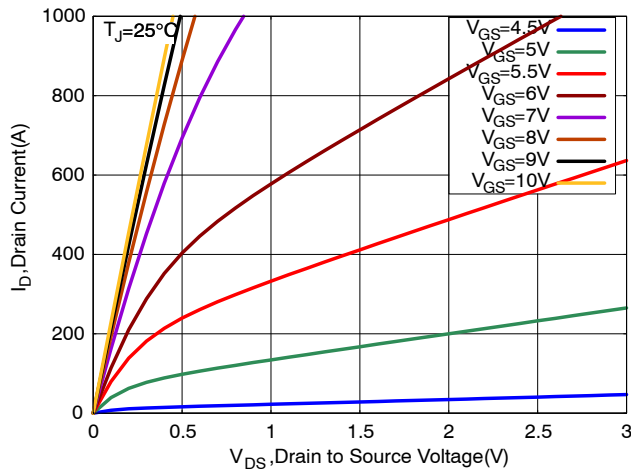


Figure 1. On-Region Characteristics

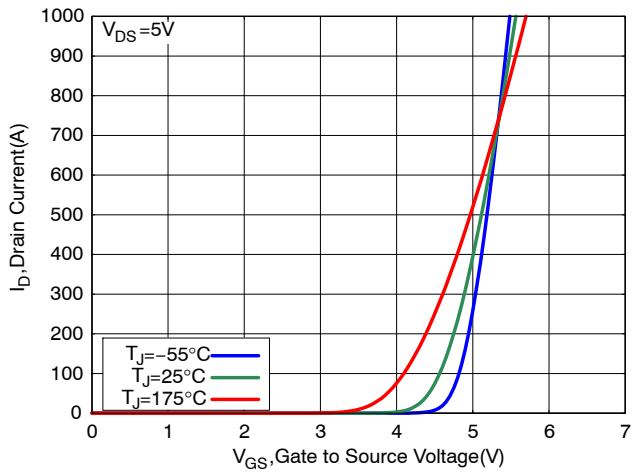


Figure 2. Transfer Characteristics

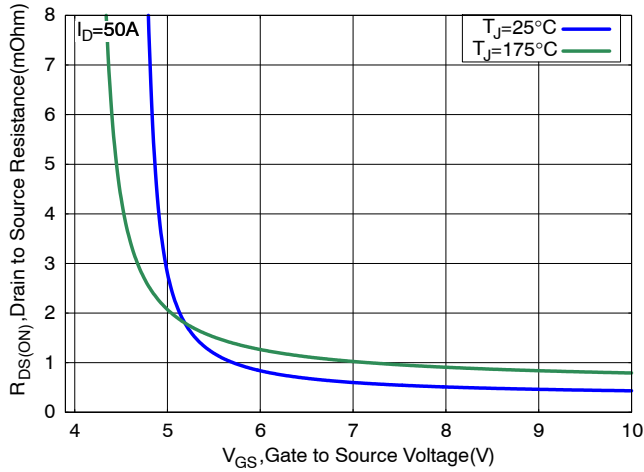


Figure 3. On-Resistance vs. Gate Voltage

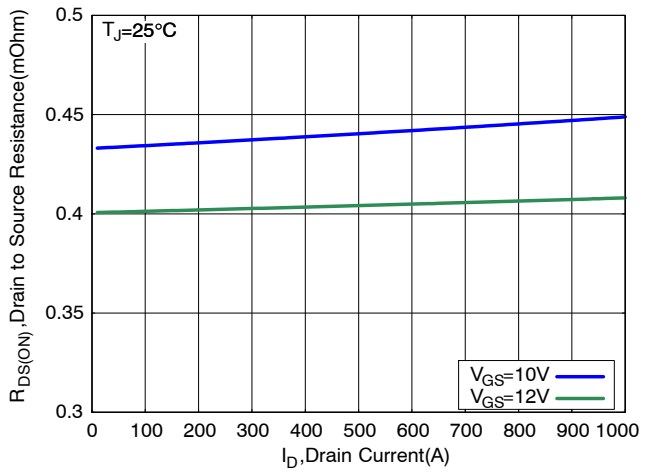


Figure 4. On-Resistance vs. Drain Current

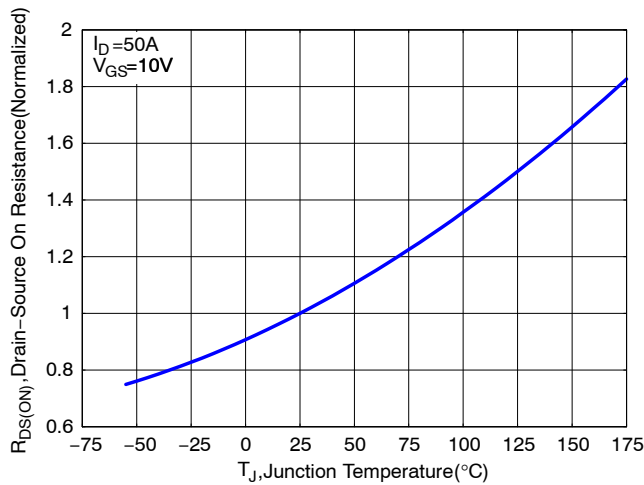


Figure 5. Normalized ON Resistance vs. Junction Temperature

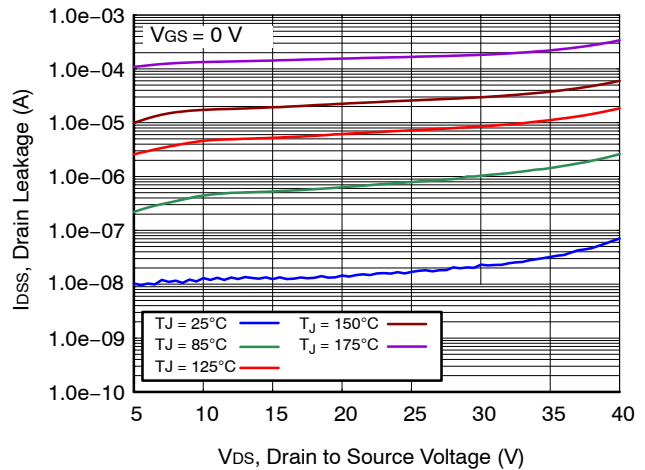


Figure 6. Drain Leakage vs. Drain to Source Voltage

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TYPICAL CHARACTERISTICS (continued)

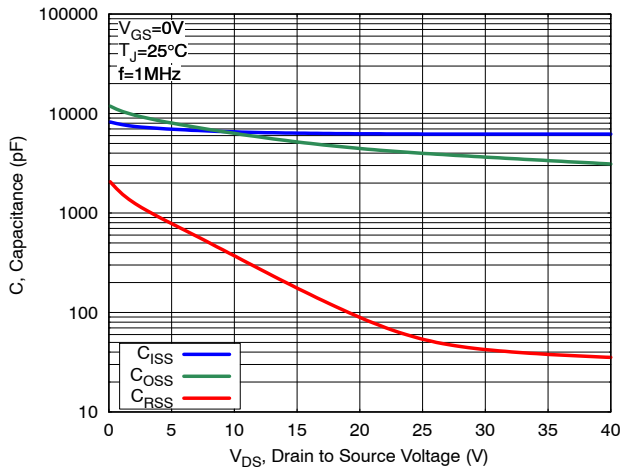


Figure 7. Capacitance Characteristics

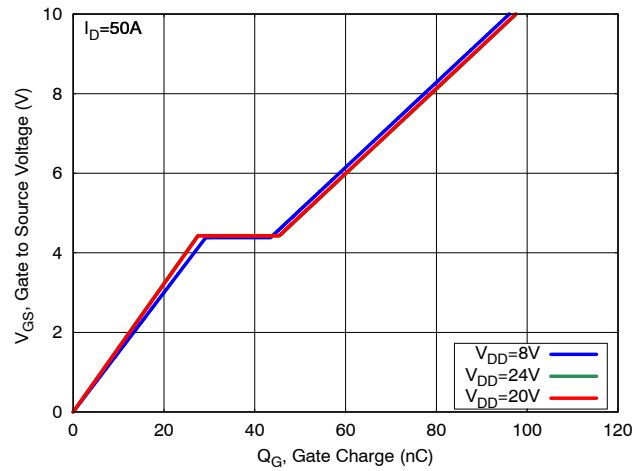


Figure 8. Gate Charge Characteristics

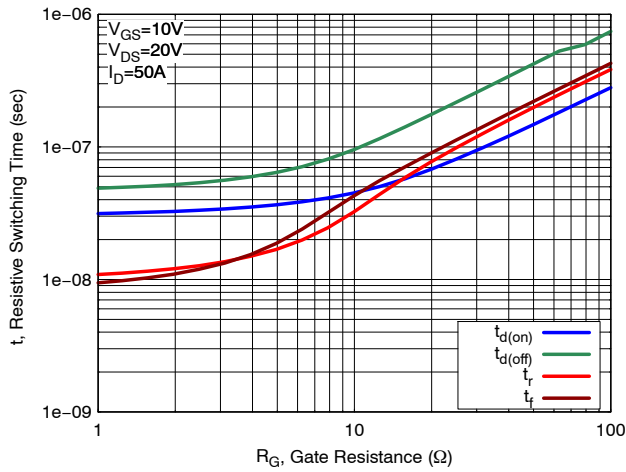


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

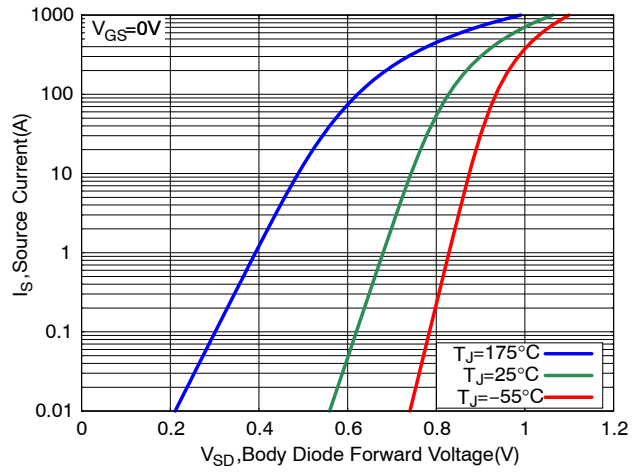


Figure 10. Diode Forward Characteristics

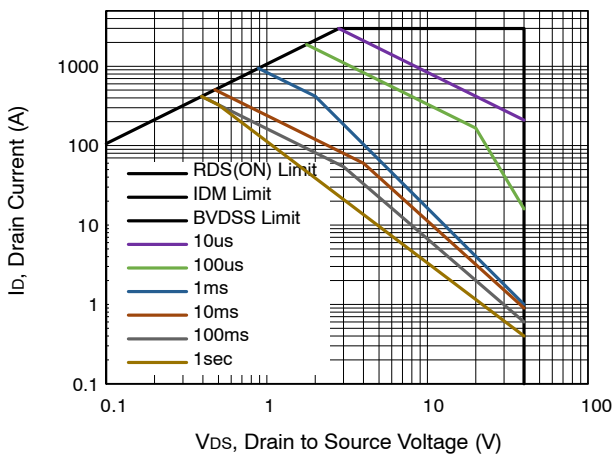


Figure 11. Maximum Rated Forward Biased Safe Operating Area

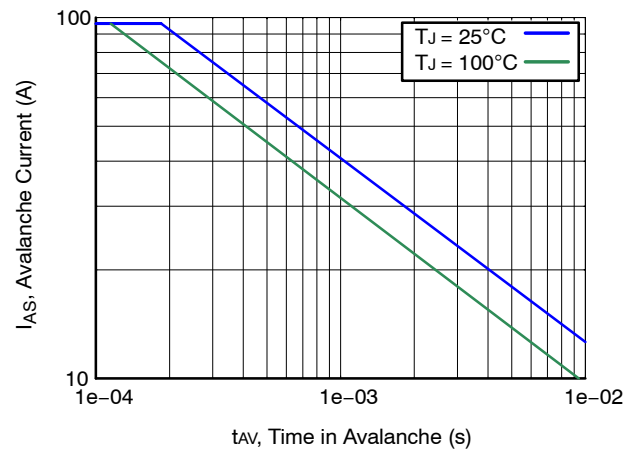


Figure 12. I_{peak} vs. Time in Avalanche

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TYPICAL CHARACTERISTICS (continued)

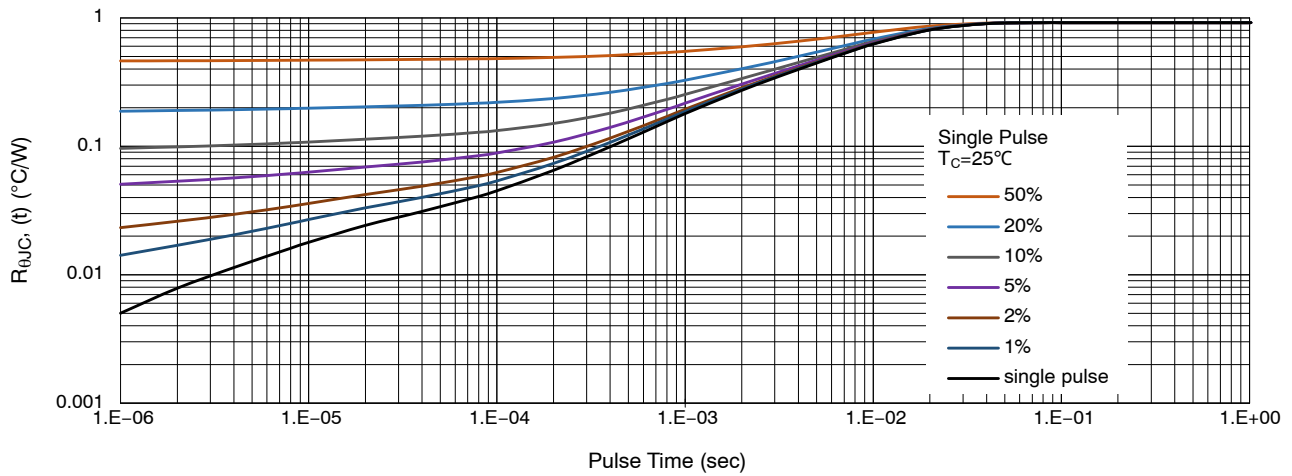


Figure 13. Thermal Response

DEVICE ORDERING INFORMATION

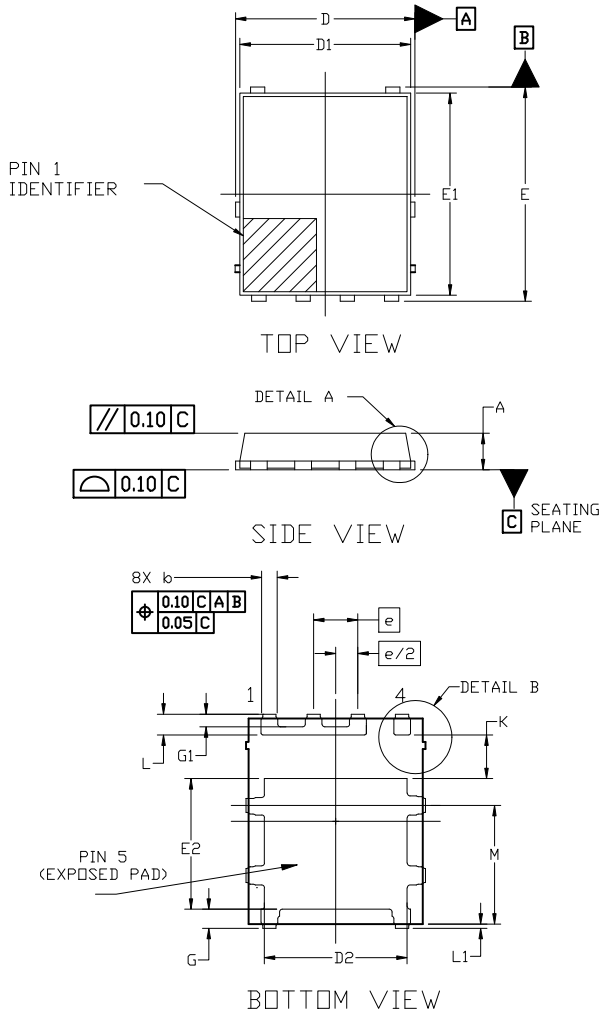
| Device | Marking | Package | Shipping [†] |
|------------------|---------|-------------------|-----------------------|
| NTMFS0D5N04XMT1G | 0D5N4 | DFN5 (Pb-Free) | 1500 / Tape & Reel |

[†]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.

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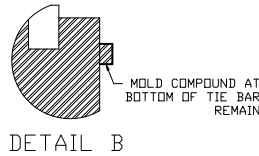
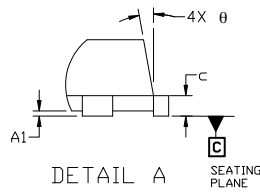
PACKAGE DIMENSIONS

DFN5 5x6, 1.27P
CASE 506FA
ISSUE O

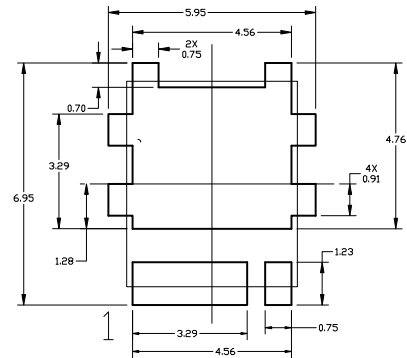


NOTES:

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 |
| 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° |



RECOMMENDED MOUNTING FOOTPRINT

- * 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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