

MOSFET - Power, Single N-Channel, μ 8FL

60 V, 22.6 m Ω , 24 A



ON Semiconductor®

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NVTFS024N06C

Features

- Small Footprint (3.3 x 3.3 mm) for Compact Design
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Q_G and Capacitance to Minimize Driver Losses
- NVTFS024N06C – Wettable Flank Option for Enhanced Optical Inspection
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR 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)

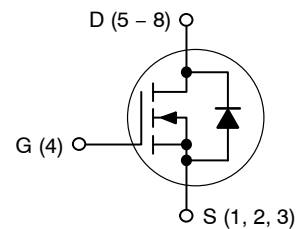
| Parameter | Symbol | Value | Unit |
|--|--|---------------------------|------------------|
| Drain-to-Source Voltage | V_{DSS} | 60 | V |
| Gate-to-Source Voltage | V_{GS} | ± 20 | V |
| Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3) | Steady State | $T_C = 25^\circ\text{C}$ | I_D 24 A |
| | | $T_C = 100^\circ\text{C}$ | 17 |
| Power Dissipation $R_{\theta JC}$ (Note 1) | Steady State | $T_C = 25^\circ\text{C}$ | P_D 28 W |
| | | $T_C = 100^\circ\text{C}$ | 14 |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3) | Steady State | $T_A = 25^\circ\text{C}$ | I_D 7 A |
| | | $T_A = 100^\circ\text{C}$ | 5 |
| Power Dissipation $R_{\theta JA}$ (Notes 1, 2) | Steady State | $T_A = 25^\circ\text{C}$ | P_D 2.5 W |
| | | $T_A = 100^\circ\text{C}$ | 1.2 |
| Pulsed Drain Current | $T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$ | I_{DM} 112 | A |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | -55 to +175 | $^\circ\text{C}$ |
| Source Current (Body Diode) | I_S | 23 | A |
| Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 5.3 \text{ A}$) | E_{AS} | 14 | 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.

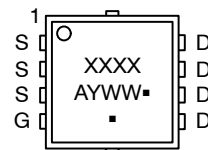
1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using a 650 mm², 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | I_D MAX |
|---------------|------------------------|-----------|
| 60 V | 22.6 m Ω @ 10 V | 24 A |

N-Channel



MARKING DIAGRAM



XXXX = Specific Device Code
 A = Assembly Location
 Y = Year
 WW = Work Week
 ■ = Pb-Free Package
 (Note: Microdot may be in either location)

ORDERING INFORMATION

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

NVTFS024N06C

THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Value | Unit |
|---|-----------------|-------|------|
| Junction-to-Case – Steady State (Note 2) | $R_{\theta JC}$ | 5.3 | °C/W |
| Junction-to-Ambient – Steady State (Note 2) | $R_{\theta JA}$ | 59.8 | |

4. Surface-mounted on FR4 board using a 650 mm², 2 oz. Cu pad.

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

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

OFF CHARACTERISTICS

| | | | | | | |
|---|-------------------|---|---------------------------|----|-----|---------------|
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$ | 60 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $I_D = 250\ \mu\text{A}$, referenced to 25°C | | 27 | | mV/°C |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$ | $T_J = 25^\circ\text{C}$ | | 10 | μA |
| | | | $T_J = 125^\circ\text{C}$ | | 250 | |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$ | | | 100 | nA |

ON CHARACTERISTICS (Note 5)

| | | | | | | |
|--|------------------|--|-----|------|------|-------|
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = 20\ \mu\text{A}$ | 2.0 | | 4.0 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | $I_D = 20\ \mu\text{A}$, referenced to 25°C | | -7.8 | | mV/°C |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 3\text{ A}$ | | 18.8 | 22.6 | mΩ |
| Forward Transconductance | g_{FS} | $V_{DS} = 5\text{ V}, I_D = 3\text{ A}$ | | 10 | | S |
| Gate-Resistance | R_G | $T_A = 25^\circ\text{C}$ | | 0.8 | | Ω |

CHARGES AND CAPACITANCES

| | | | | | | |
|------------------------------|--------------|--|--|------|--|----|
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 30\text{ V}$ | | 333 | | pF |
| Output Capacitance | C_{oss} | | | 225 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 5.05 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 48\text{ V}, I_D = 3\text{ A}$ | | 5.7 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 1.3 | | |
| Gate-to-Source Charge | Q_{GS} | | | 2.0 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 0.68 | | |

SWITCHING CHARACTERISTICS (Note 6)

| | | | | | | |
|---------------------|--------------|---|--|-----|--|----|
| Turn-On Delay Time | $t_{d(on)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 48\text{ V}, I_D = 3\text{ A}, R_G = 6\ \Omega$ | | 6.6 | | ns |
| Rise Time | t_r | | | 1.3 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 10 | | |
| Fall Time | t_f | | | 3.0 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-------------------------|----------|---|---------------------------|--|------|-----|----|
| Forward Diode Voltage | V_{SD} | $V_{GS} = 0\text{ V}, I_S = 3\text{ A}$ | $T_J = 25^\circ\text{C}$ | | 0.8 | 1.2 | V |
| | | | $T_J = 125^\circ\text{C}$ | | 0.66 | | |
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s}, V_{DS} = 30\text{ V}, I_S = 2\text{ A}$ | | | 23 | | ns |
| Charge Time | t_a | | | | 11 | | |
| Discharge Time | t_b | | | | 12 | | |
| Reverse Recovery Charge | Q_{RR} | | | | 11 | | |

5. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

6. Switching characteristics are independent of operating junction temperatures.

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

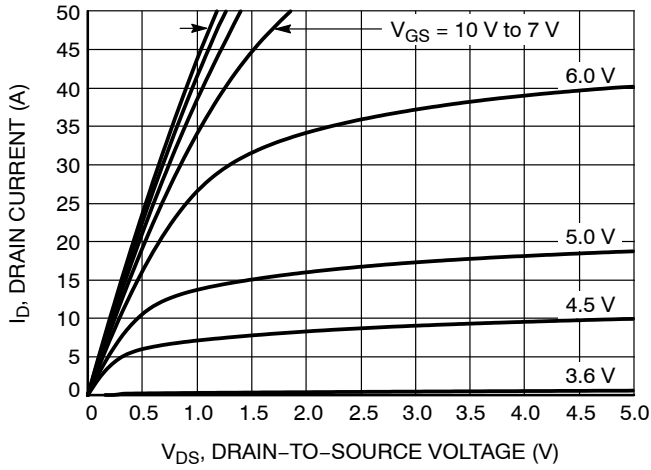


Figure 1. On-Region Characteristics

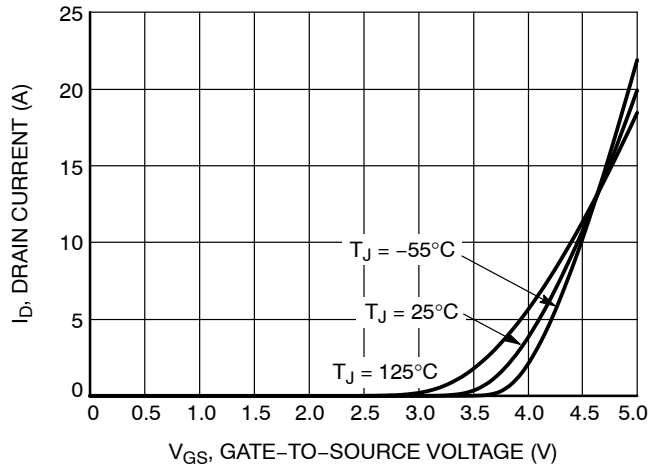


Figure 2. Transfer Characteristics

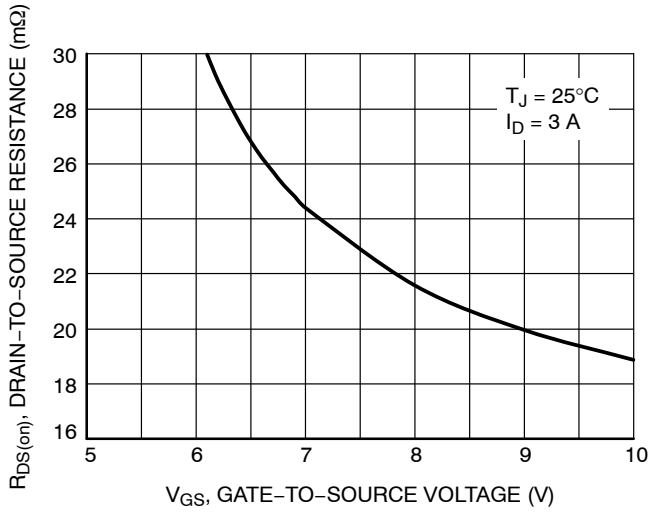


Figure 3. On-Resistance vs. Gate-to-Source Voltage

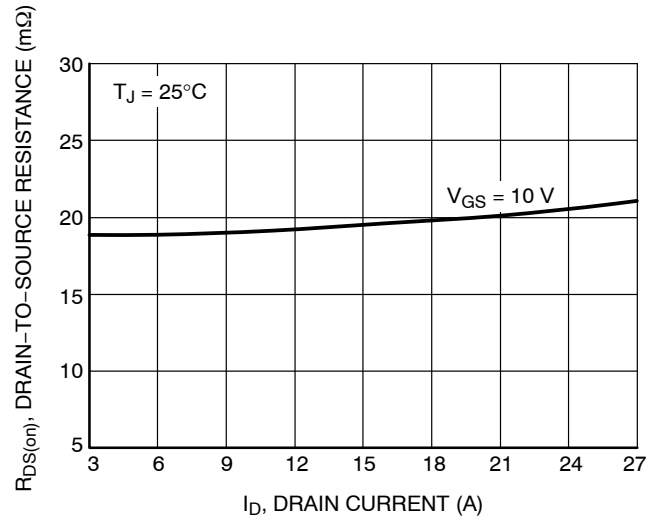


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

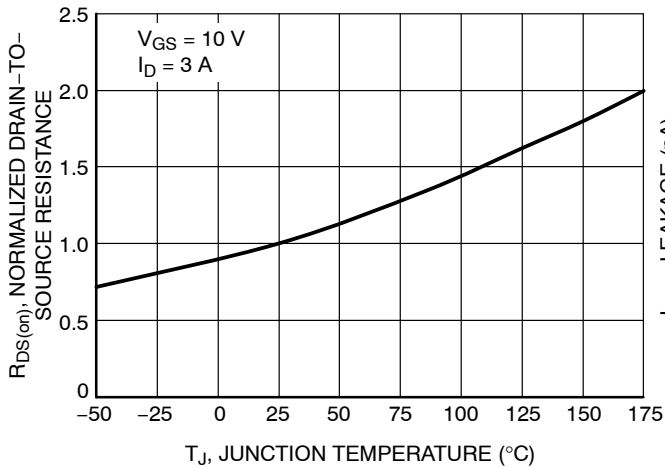


Figure 5. On-Resistance Variation with Temperature

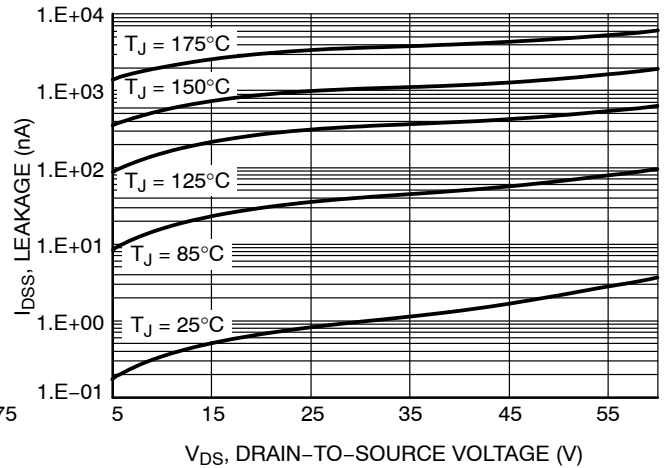


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

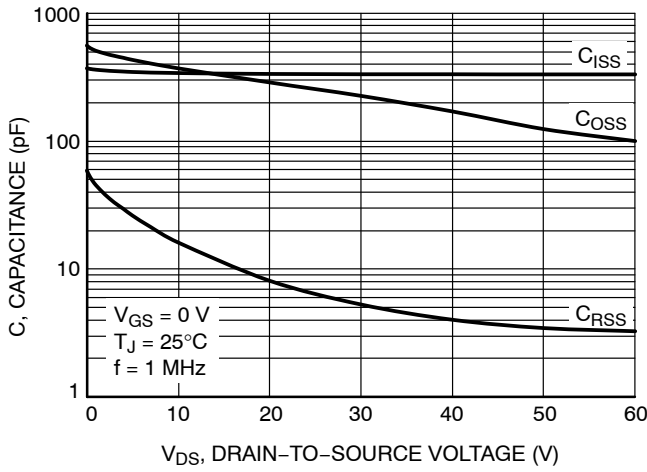


Figure 7. Capacitance Variation

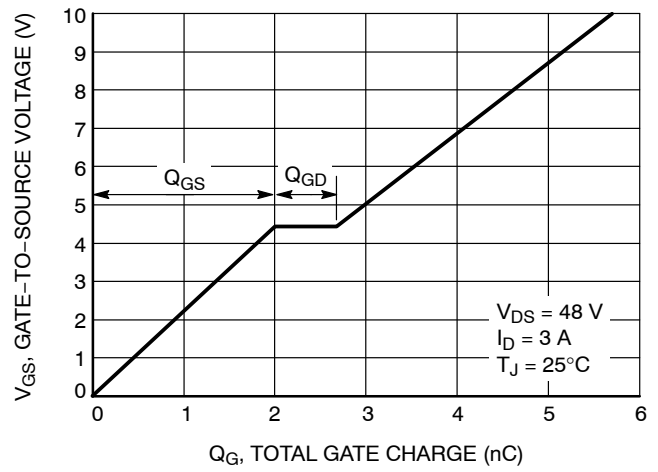


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

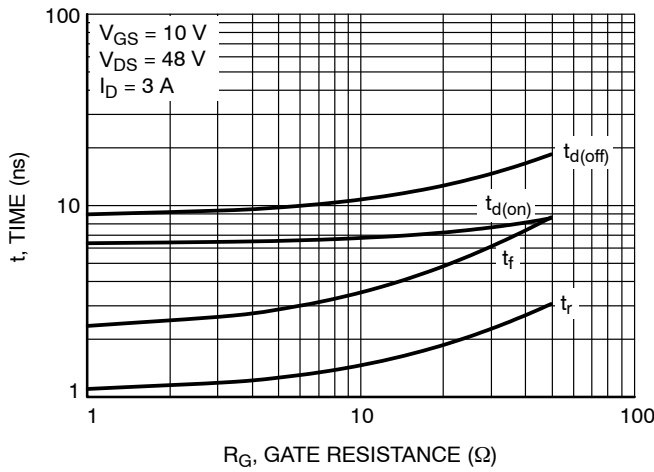


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

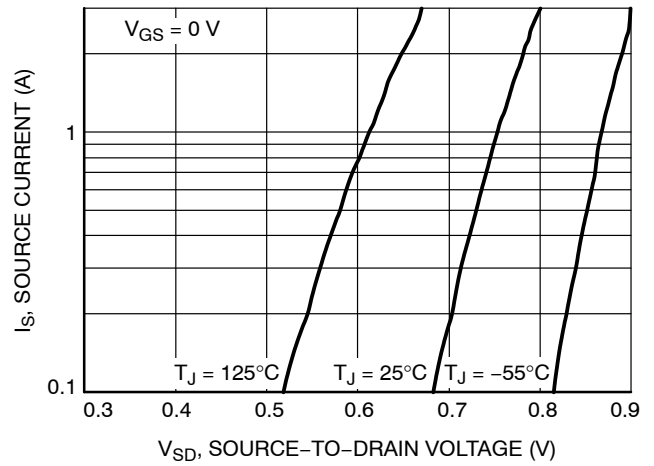


Figure 10. Diode Forward Voltage vs. Current

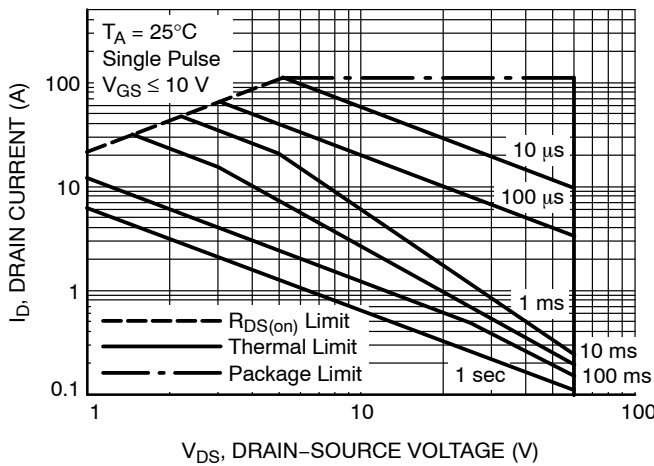


Figure 11. Safe Operating Area

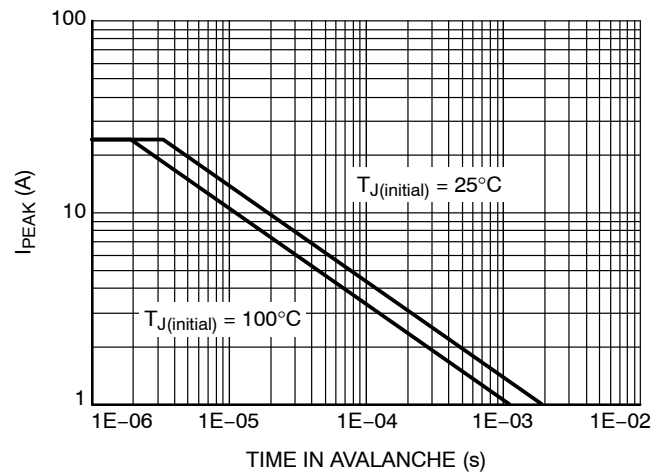


Figure 12. Maximum Drain Current vs. Time in Avalanche

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TYPICAL CHARACTERISTICS

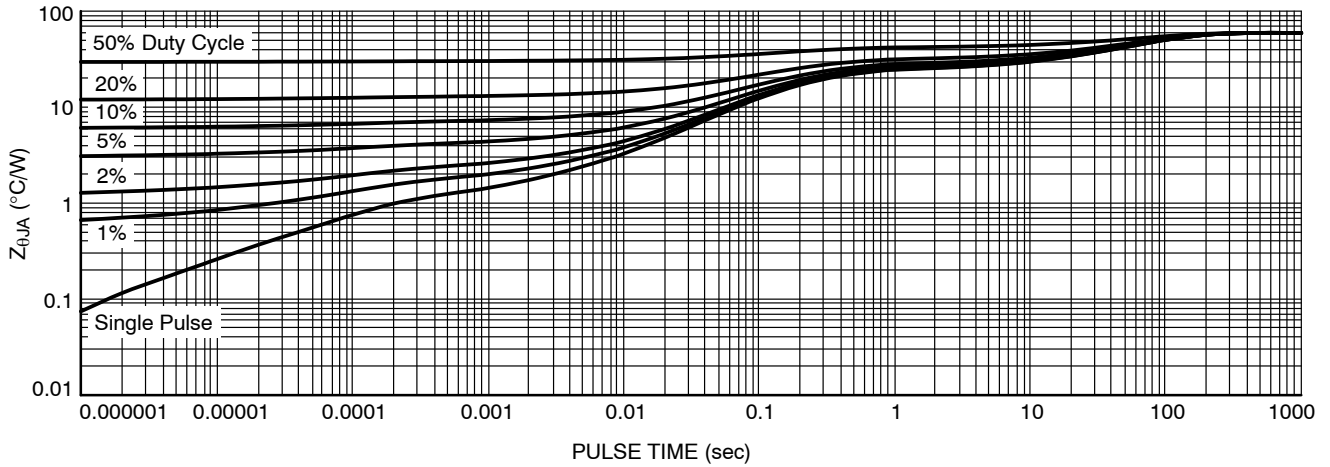


Figure 13. Thermal Characteristics

DEVICE ORDERING INFORMATION

| Device | Marking | Package | Shipping† |
|------------------|---------|---|--------------------|
| NVTFS024N06CTAG | 24NC | μ 8FL (Pb-Free) | 1500 / Tape & Reel |
| NVTFWS024N06CTAG | 24NW | μ 8FL (Pb-Free, Wettable Flanks) | 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.

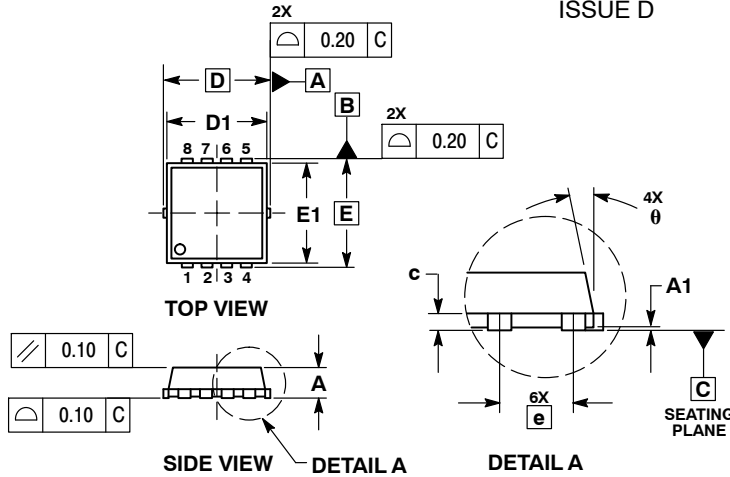
NVTFS024N06C

PACKAGE DIMENSIONS

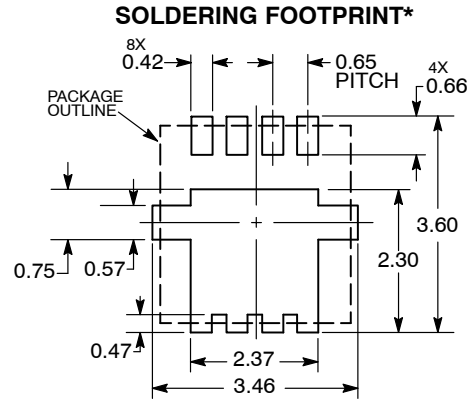
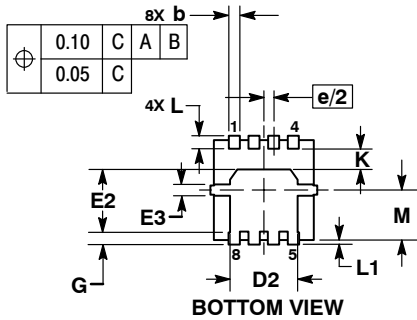
WDFN8 3.3x3.3, 0.65P
CASE 511AB
ISSUE D

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.



| DIM | MILLIMETERS | | | INCHES | | |
|-----|-------------|------|------|-----------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.70 | 0.75 | 0.80 | 0.028 | 0.030 | 0.031 |
| A1 | 0.00 | --- | 0.05 | 0.000 | --- | 0.002 |
| b | 0.23 | 0.30 | 0.40 | 0.009 | 0.012 | 0.016 |
| c | 0.15 | 0.20 | 0.25 | 0.006 | 0.008 | 0.010 |
| D | 3.30 BSC | | | 0.130 BSC | | |
| D1 | 2.95 | 3.05 | 3.15 | 0.116 | 0.120 | 0.124 |
| D2 | 1.98 | 2.11 | 2.24 | 0.078 | 0.083 | 0.088 |
| E | 3.30 BSC | | | 0.130 BSC | | |
| E1 | 2.95 | 3.05 | 3.15 | 0.116 | 0.120 | 0.124 |
| E2 | 1.47 | 1.60 | 1.73 | 0.058 | 0.063 | 0.068 |
| E3 | 0.23 | 0.30 | 0.40 | 0.009 | 0.012 | 0.016 |
| e | 0.65 BSC | | | 0.026 BSC | | |
| G | 0.30 | 0.41 | 0.51 | 0.012 | 0.016 | 0.020 |
| K | 0.65 | 0.80 | 0.95 | 0.026 | 0.032 | 0.037 |
| L | 0.30 | 0.43 | 0.56 | 0.012 | 0.017 | 0.022 |
| L1 | 0.06 | 0.13 | 0.20 | 0.002 | 0.005 | 0.008 |
| M | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 |
| θ | 0° | --- | 12° | 0° | --- | 12° |



DIMENSION: MILLIMETERS

*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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