

MOSFET – Power, Single N-Channel, SO-8 FL

60 V, 22 mΩ, 25 A

NVMFS024N06C

Features

- Small Footprint (5x6 mm) for Compact Design
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Q_G and Capacitance to Minimize Driver Losses
- NVMFWS024N06C – 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

Applications

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

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

| Symbol | Parameter | | Value | Unit |
|----------------|--|---|---------------------------|------------------|
| V_{DSS} | Drain-to-Source Voltage | | 60 | V |
| V_{GS} | Gate-to-Source Voltage | | ± 20 | V |
| I_D | Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3) | Steady State | $T_C = 25^\circ\text{C}$ | A |
| | | | $T_C = 100^\circ\text{C}$ | |
| P_D | Power Dissipation $R_{\theta JC}$ (Note 1) | Steady State | $T_C = 25^\circ\text{C}$ | W |
| | | | $T_C = 100^\circ\text{C}$ | |
| I_D | Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3) | Steady State | $T_A = 25^\circ\text{C}$ | A |
| | | | $T_A = 100^\circ\text{C}$ | |
| P_D | Power Dissipation $R_{\theta JA}$ (Notes 1, 2) | Steady State | $T_A = 25^\circ\text{C}$ | W |
| | | | $T_A = 100^\circ\text{C}$ | |
| I_{DM} | Pulsed Drain Current | $T_A = 25^\circ\text{C}$, $t_p = 10 \mu\text{s}$ | 158 | A |
| T_J, T_{STG} | Operating Junction and Storage Temperature Range | | -55 to +175 | $^\circ\text{C}$ |
| I_S | Source Current (Body Diode) | | 23 | A |
| E_{AS} | Single Pulse Drain-to-Source Avalanche Energy ($I_L = 5.3 A_{pk}$) | | 14 | mJ |
| T_L | Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | | 260 | $^\circ\text{C}$ |

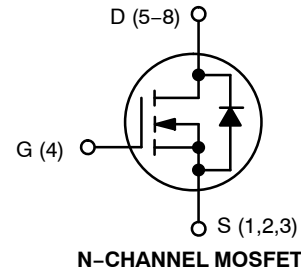
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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.

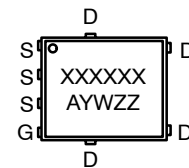
THERMAL RESISTANCE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|-----------------|---|-------|---------------------------|
| $R_{\theta JC}$ | Junction-to-Case – Steady State (Note 1) | 5.3 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Junction-to-Ambient – Steady State (Note 1) | 43.4 | |

| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ MAX}$ | $I_D \text{ MAX}$ |
|---------------|--------------------------|-------------------|
| 60 V | 22 mΩ @ 10 V | 25 A |



MARKING DIAGRAM



XXXXXX = 24N06C
 (NVMFS024N06C) or
 24N06W
 (NVMFWS024N06C)

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.

NVMFS024N06C

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

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

OFF CHARACTERISTICS

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

ON CHARACTERISTICS (Note 4)

| | | | | | | |
|------------------|--|---|-----|------|-----|----------------------|
| $V_{GS(TH)}$ | Gate Threshold Voltage | $V_{GS} = V_{DS}, I_D = 20\text{ }\mu\text{A}$ | 2.0 | | 4.0 | V |
| $V_{GS(TH)}/T_J$ | Negative Threshold Temperature Coefficient | $I_D = 17\text{ }\mu\text{A}$, ref to 25°C | | -7.8 | | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$ | Drain-to-Source On Resistance | $V_{GS} = 10\text{ V}, I_D = 3\text{ A}$ | | 18.3 | 22 | m Ω |
| g_{FS} | Forward Transconductance | $V_{DS} = 5\text{ V}, I_D = 3\text{ A}$ | | 10 | | S |
| R_G | Gate Resistance | $T_A = 25^\circ\text{C}$ | | 0.8 | | Ω |

CHARGES AND CAPACITANCES

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

SWITCHING CHARACTERISTICS, $V_{GS} = 10\text{ V}$ (Note 5)

| | | | | | | |
|--------------|---------------------|---|--|-----|--|----|
| $t_{d(ON)}$ | Turn-On Delay Time | $V_{GS} = 10\text{ V}, V_{DS} = 48\text{ V}, I_D = 3\text{ A}, R_G = 6.0\text{ }\Omega$ | | 6.6 | | ns |
| t_r | Rise Time | | | 1.3 | | |
| $t_{d(OFF)}$ | Turn-Off Delay Time | | | 10 | | |
| t_f | Fall Time | | | 3.0 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|----------|-------------------------|---|---------------------------|----|------|-----|---|
| V_{SD} | Forward Diode Voltage | $V_{GS} = 0\text{ V}, I_S = 3\text{ A}$ | $T_J = 25^\circ\text{C}$ | | 0.8 | 1.2 | V |
| | | | $T_J = 125^\circ\text{C}$ | | 0.66 | | |
| t_{RR} | Reverse Recovery Time | $V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}, V_{DS} = 30\text{ V}, I_S = 3\text{ A}$ | | 23 | | ns | |
| t_a | Charge Time | | | 11 | | | |
| t_b | Discharge Time | | | 12 | | | |
| Q_{RR} | Reverse Recovery Charge | | | 11 | | 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. Pulse Test: pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

5. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

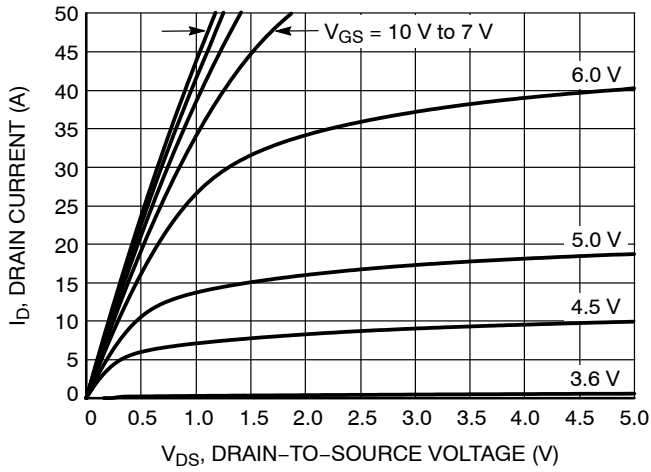


Figure 1. On-Region Characteristics

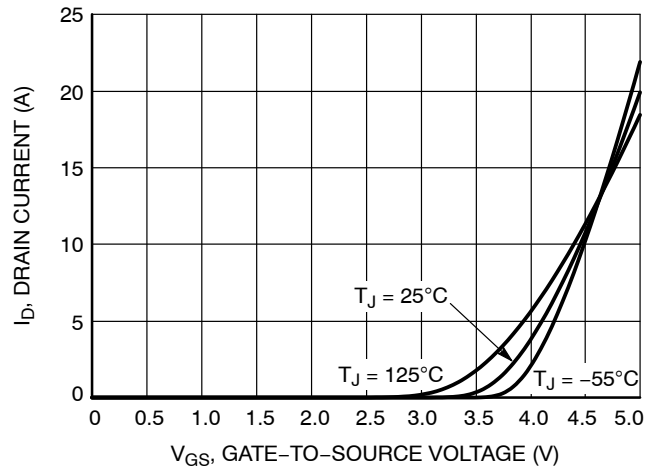


Figure 2. Transfer Characteristics

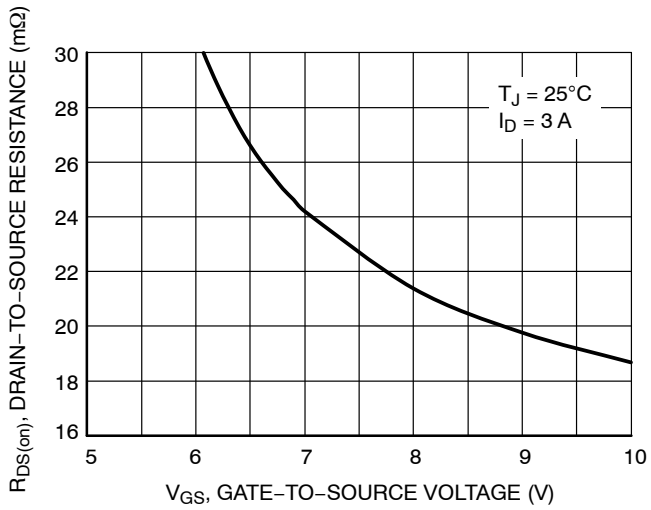


Figure 3. On-Resistance vs. Gate-to-Source Voltage

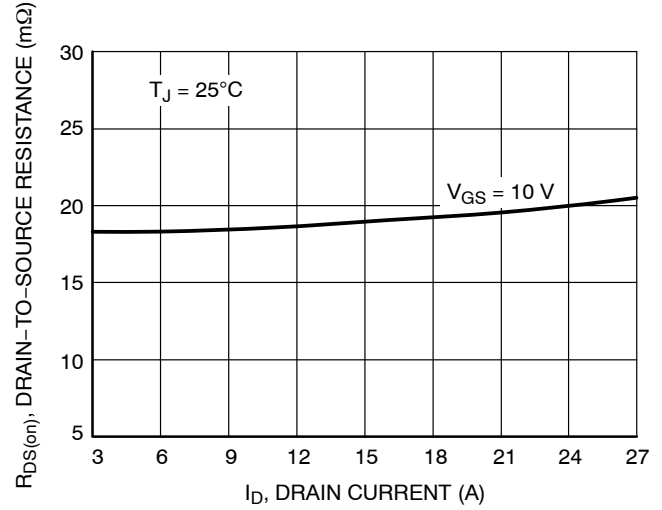


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

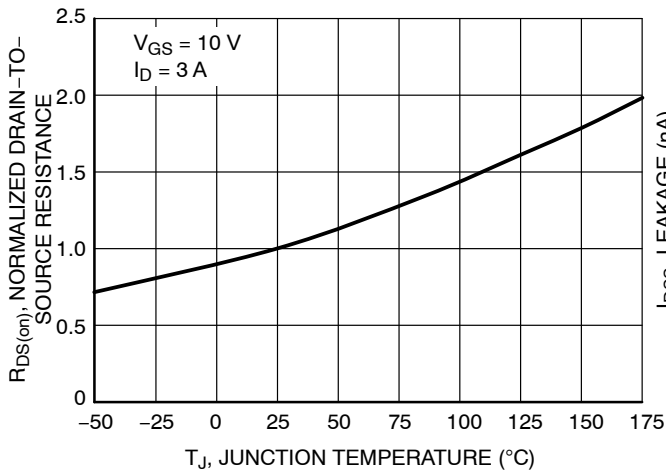


Figure 5. On-Resistance Variation with Temperature

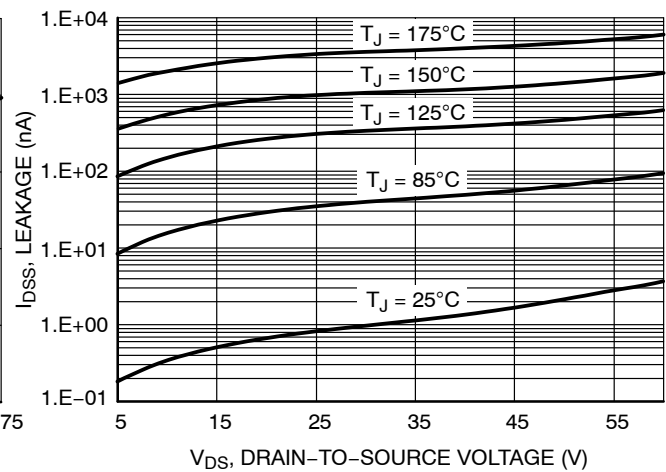


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS (continued)

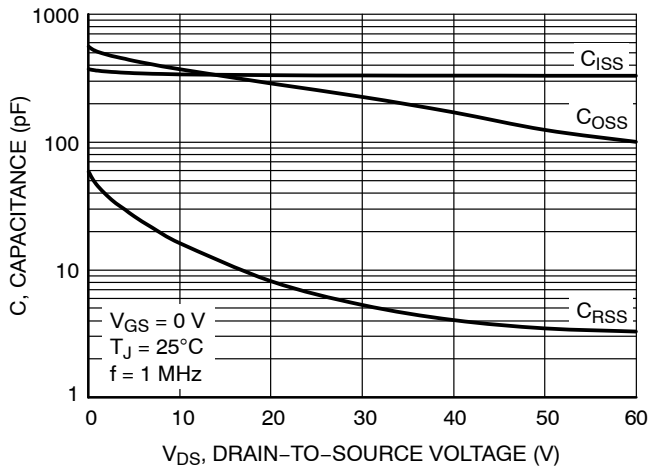


Figure 7. Capacitance Variation

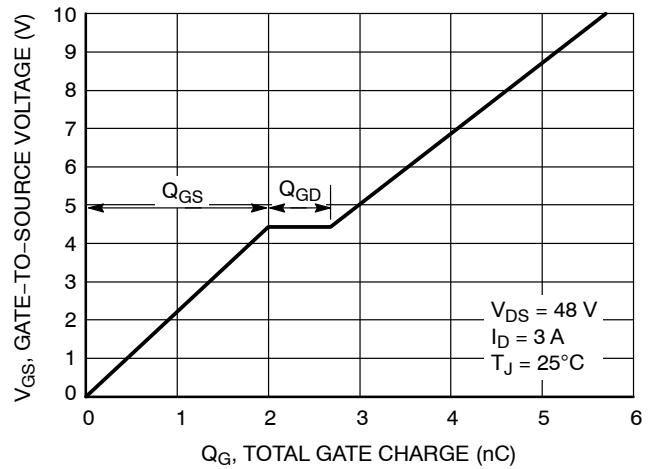


Figure 8. Gate-to-Source Voltage vs. Total Charge

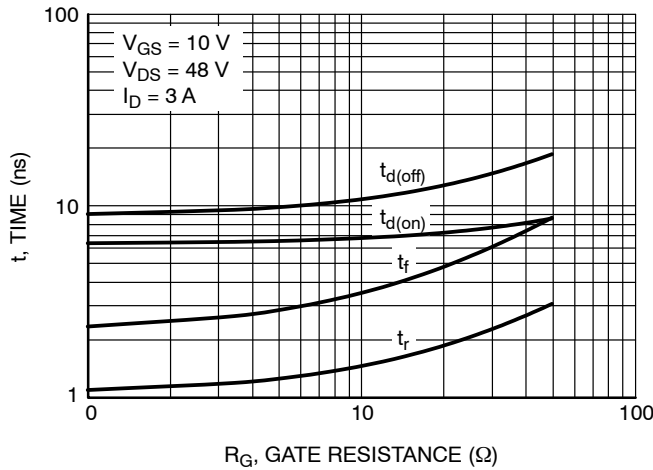


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

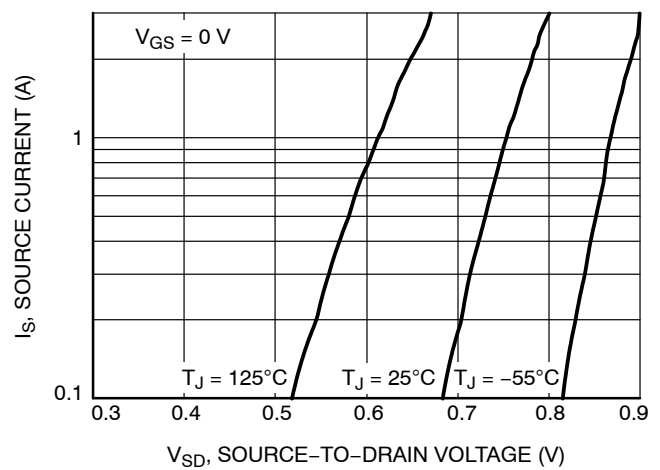


Figure 10. Diode Forward Voltage vs. Current

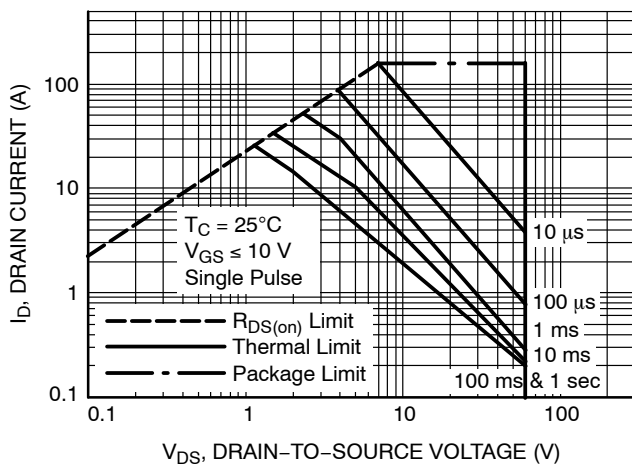


Figure 11. Maximum Rated Forward Biased Safe Operating Area

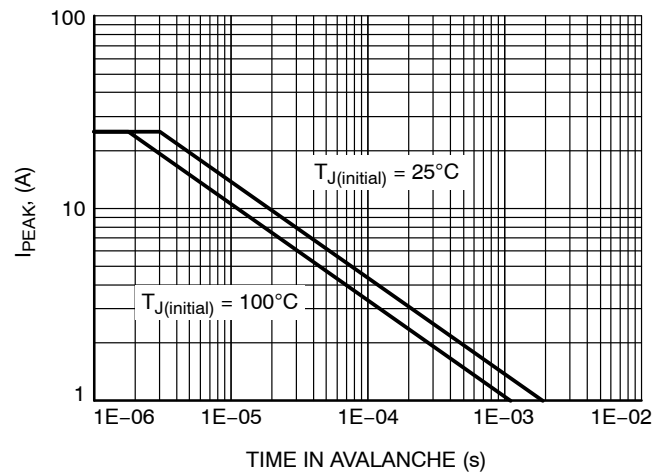


Figure 12. Maximum Drain Current vs. Time in Avalanche

NVMFS024N06C

TYPICAL CHARACTERISTICS (continued)

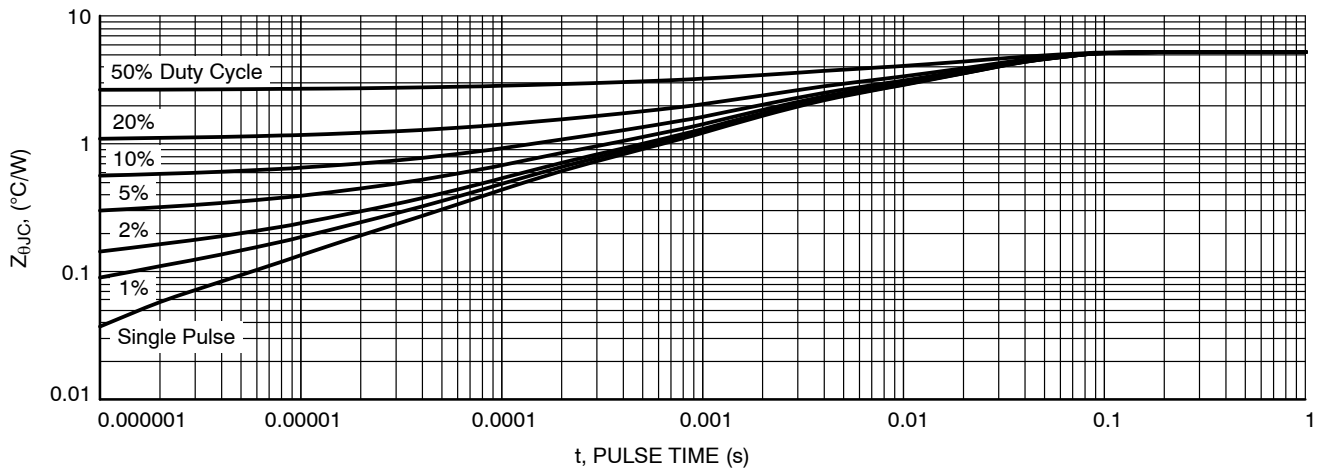


Figure 13. Thermal Response

DEVICE ORDERING INFORMATION

| Device | Marking | Package | Shipping [†] |
|------------------|---------|------------------------------------|-----------------------|
| NVMFS024N06CT1G | 24N06C | DFN5 (Pb-Free) | 1,500 / Tape & Reel |
| NVMFWS024N06CT1G | 24N06W | DFN5 (Pb-Free, Wettable Flanks) | 1,500 / 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](#).



SCALE 2:1

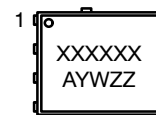
DFN5 5x6, 1.27P
(SO-8FL)
CASE 488AA
ISSUE N

DATE 25 JUN 2018

NOTES:

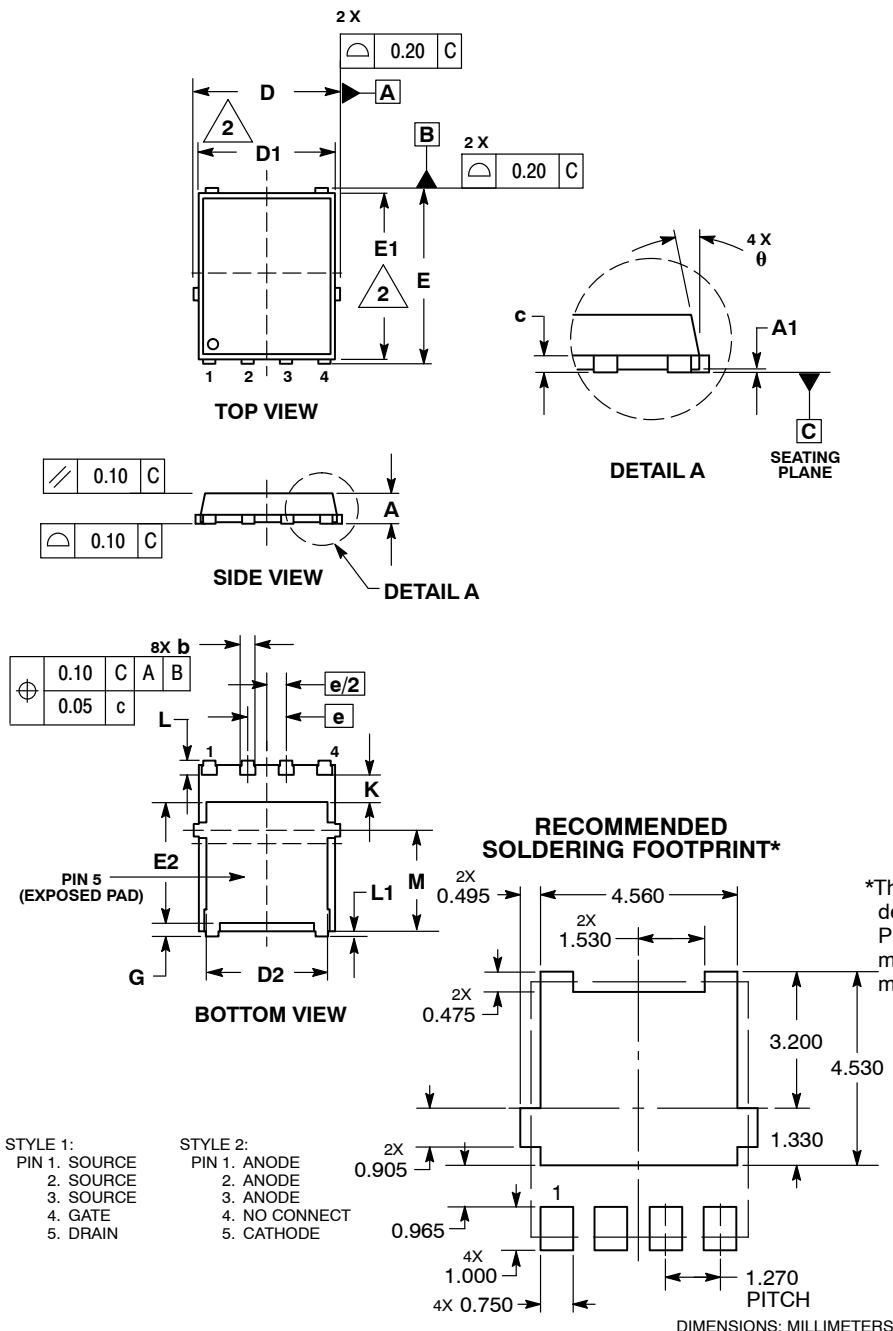
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

| DIM | MILLIMETERS | | |
|-----|-------------|-------|------|
| | 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 | 4.70 | 4.90 | 5.10 |
| D2 | 3.80 | 4.00 | 4.20 |
| E | 6.00 | 6.15 | 6.30 |
| E1 | 5.70 | 5.90 | 6.10 |
| E2 | 3.45 | 3.65 | 3.85 |
| e | 1.27 BSC | | |
| G | 0.51 | 0.575 | 0.71 |
| K | 1.20 | 1.35 | 1.50 |
| L | 0.51 | 0.575 | 0.71 |
| L1 | 0.125 REF | | |
| M | 3.00 | 3.40 | 3.80 |
| θ | 0° | --- | 12° |

GENERIC
MARKING DIAGRAM*


XXXXXX = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

*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 onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

| | | |
|-------------------------|---------------------------------|--|
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| DESCRIPTION: | DFN5 5x6, 1.27P (SO-8FL) | PAGE 1 OF 1 |

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