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# NVMFS5113PLT1G

onsemi

MOSFET SINGLE P-CHANNEL S08FL 60V 69A 1

# NVMFS5113PL

# Power MOSFET

## −60 V, 14 mΩ, −64 A, Single P−Channel

**Features**

- Low $R_{DS(on)}$ to Minimize Conduction Losses
- High Current Capability
- Avalanche Energy Specified
- NVMFS5113PLWF − Wettable Flanks Product
- NVM Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

**MAXIMUM RATINGS** ($T_J$ = 25°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, 2, 3) | Steady State | $T_C$ = 25°C | $I_D$ | −64 | A |
| | | $T_C$ = 100°C | | −45 | |
| Power Dissipation $R_{\theta JC}$ (Notes 1, 2) | | $T_C$ = 25°C | $P_D$ | 150 | W |
| | | $T_C$ = 100°C | | 75 | |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3) | Steady State | $T_A$ = 25°C | $I_D$ | −10 | A |
| | | $T_A$ = 100°C | | −7 | |
| Power Dissipation $R_{\theta JA}$ (Notes 1, 2) | | $T_A$ = 25°C | $P_D$ | 3.8 | W |
| | | $T_A$ = 100°C | | 1.9 | |
| Pulsed Drain Current | $T_A$ = 25°C, $t_p$ = 10 μs | | $I_{DM}$ | −415 | A |
| Operating Junction and Storage Temperature | | | $T_J$, $T_{stg}$ | −55 to 175 | °C |
| Source Current (Body Diode) | | | $I_S$ | −150 | A |
| Single Pulse Drain−to−Source Avalanche Energy ($T_J$ = 25°C, $V_{DD}$ = 50 V, $V_{GS}$ = 10 V, $I_{L(pk)}$ = 46 A, L = 0.3 mH, $R_G$ = 25 Ω) | | | $E_{AS}$ | 315 | 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.

**THERMAL RESISTANCE MAXIMUM RATINGS**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction−to−Case − Steady State (Drain) (Note 2) | $R_{\theta JC}$ | 1.0 | °C/W |
| Junction−to−Ambient − Steady State (Note 2) | $R_{\theta JA}$ | 39 | °C/W |

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 $mm^2$, 2 oz. Cu pad.
3. Continuous DC current rating. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

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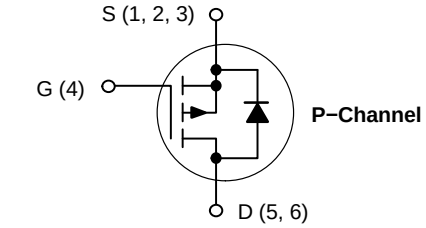
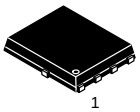
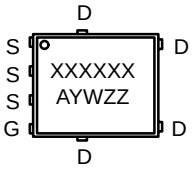
| $V_{(BR)DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|
| −60 V | 14 mΩ @ −10 V | −64 A |
| | 22 mΩ @ −4.5 V | |




**DFN5**
**CASE 488AA**
**STYLE 1**

**MARKING DIAGRAM**




A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

**ORDERING INFORMATION**

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

**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 V, $I_D$ = −250 μA | | −60 | | | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = −60 V | $T_J$ = 25°C | | | −1.0 | μA |
| | | | $T_J$ = 125°C | | | −100 | |
| Gate−to−Source Leakage Current | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±20 V | | | | ±100 | nA |
| **ON CHARACTERISTICS** (Note 4) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = −250 μA | | −1.5 | | −2.5 | V |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = −10 V, $I_D$ = −17 A | | | 10.5 | 14 | mΩ |
| | | $V_{GS}$ = −4.5 V, $I_D$ = −5 A | | | 16 | 22 | |
| Froward Transconductance | $g_{FS}$ | $V_{DS}$ = −15 V, $I_D$ = −15 A | | | 43 | | S |
| **CHARGES AND CAPACITANCES** | | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, f = 1.0 MHz, $V_{DS}$ = −25 V | | | 4400 | | pF |
| Output Capacitance | $C_{oss}$ | | | | 505 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | | 319 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{DS}$ = −48 V, $I_D$ = −17 A | $V_{GS}$ = −4.5 V | | 45 | | nC |
| | | | $V_{GS}$ = −10 V | | 83 | | |
| Threshold Gate Charge | $Q_{G(TH)}$ | $V_{GS}$ = −10 V, $V_{DS}$ = −48 V, $I_D$ = −17 A | | | 4 | | |
| Gate−to−Source Charge | $Q_{GS}$ | | | | 13 | | |
| Gate−to−Drain Charge | $Q_{GD}$ | | | | 27 | | |
| Plateau Voltage | $V_{GP}$ | | | | 3.5 | | V |
| **SWITCHING CHARACTERISTICS** (Notes 4) | | | | | | | |
| Turn−On Delay Time | $t_{d(on)}$ | $V_{GS}$ = −10 V, $V_{DS}$ = −48 V, $I_D$ = −17 A, $R_G$ = 2.5 Ω | | | 15 | | ns |
| Rise Time | $t_r$ | | | | 37 | | |
| Turn−Off Delay Time | $t_{d(off)}$ | | | | 54 | | |
| Fall Time | $t_f$ | | | | 77 | | |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = −17 A | $T_J$ = 25°C | | −0.79 | −1.0 | V |
| | | | $T_J$ = 125°C | | −0.65 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, $dI_S/dt$ = 100 A/μs, $I_S$ = −17 A | | | 41 | | ns |
| Charge Time | $t_a$ | | | | 22 | | |
| Discharge Time | $t_b$ | | | | 19 | | |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 50 | | 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 ≤ 300 μs, Duty Cycle ≤ 2%.

## TYPICAL CHARACTERISTICS

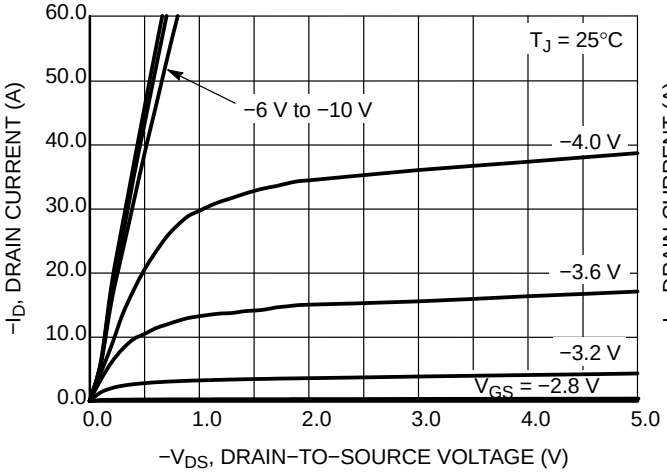



**Figure 1. On−Region Characteristics**

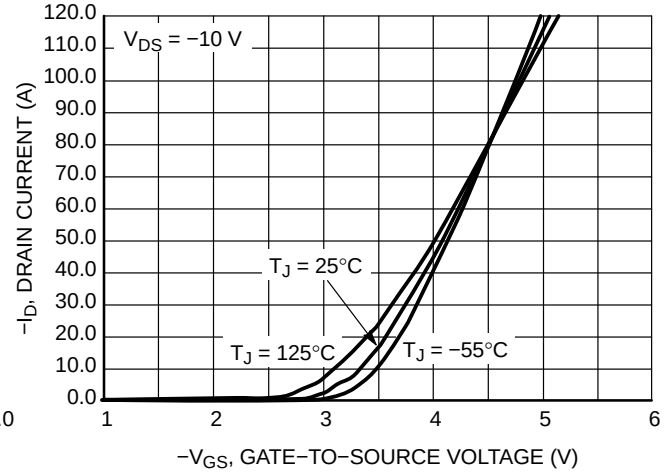



**Figure 2. Transfer Characteristics**

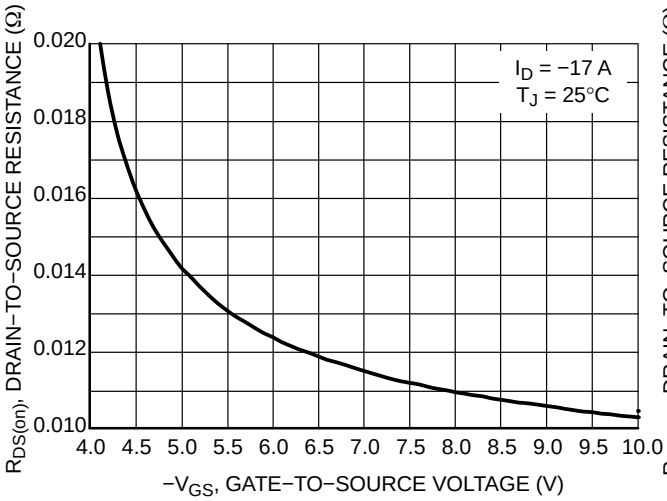



**Figure 3. On−Resistance vs. Gate−to−Source Voltage**

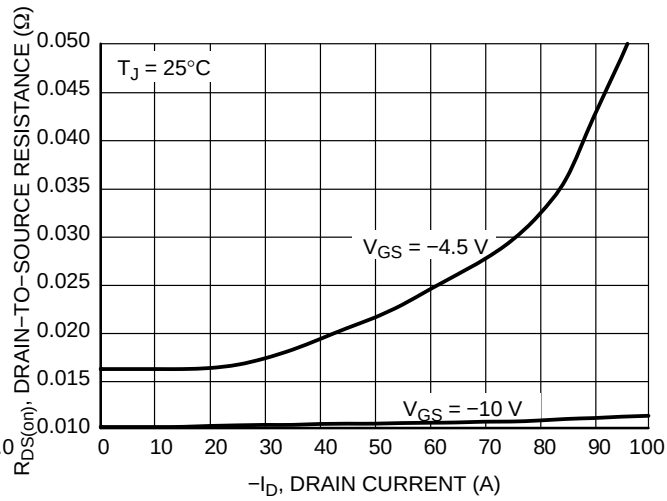



**Figure 4. On−Resistance vs. Drain Current and Gate Voltage**

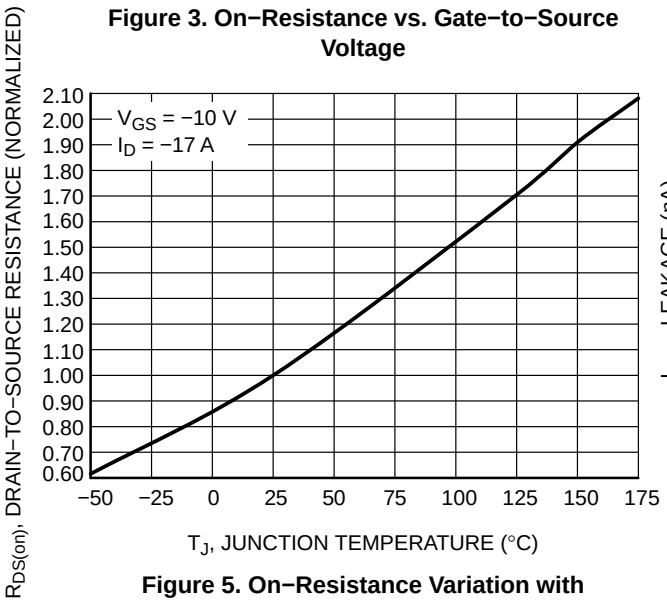



**Figure 5. On−Resistance Variation with Temperature**

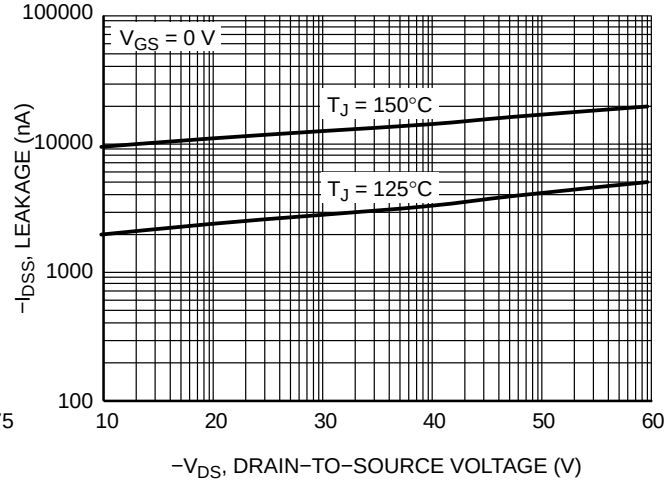



**Figure 6. Drain−to−Source Leakage Current vs. Voltage**

## TYPICAL CHARACTERISTICS

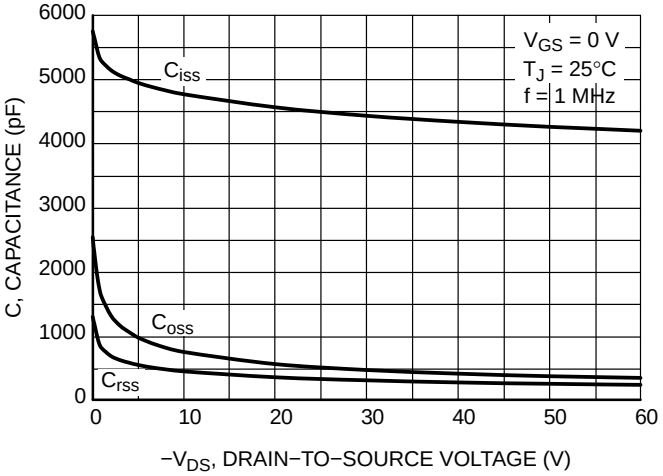



**Figure 7. Capacitance Variation**

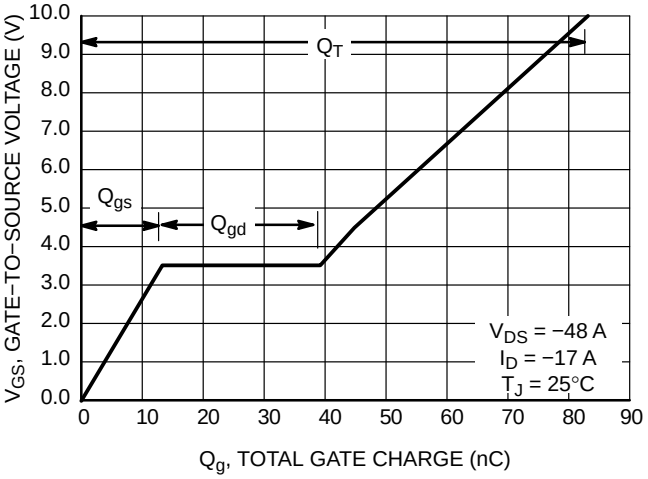



**Figure 8. Gate−to−Source Voltage vs. Total Charge**

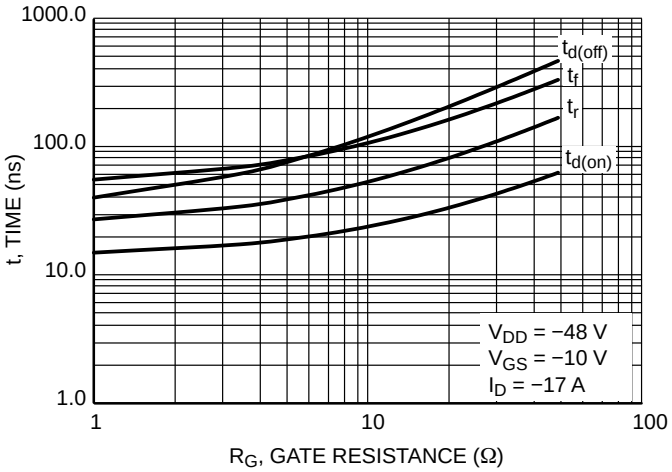



**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**

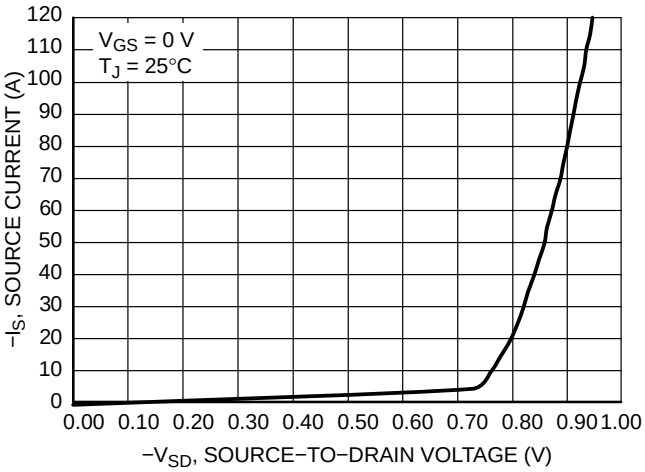



**Figure 10. Diode Forward Voltage vs. Current**

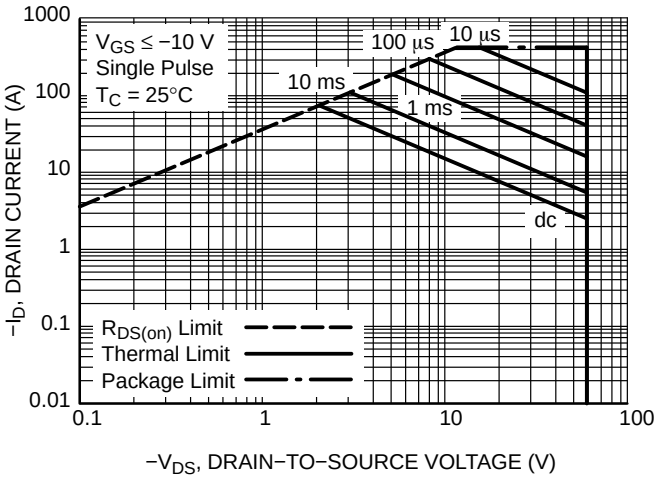



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**

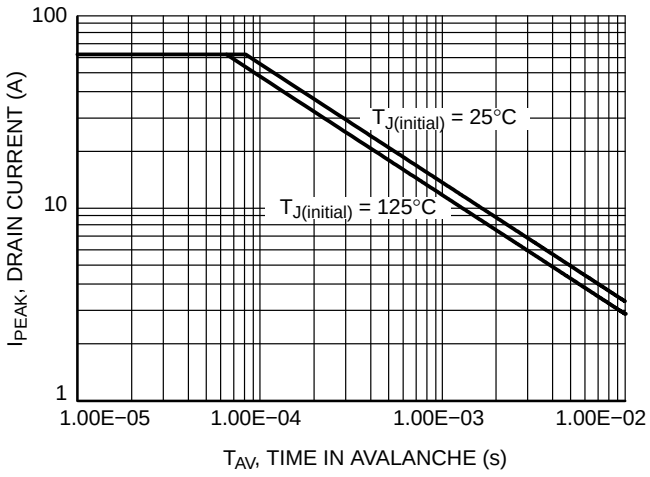



**Figure 12. Avalanche Characteristics**

## TYPICAL CHARACTERISTICS

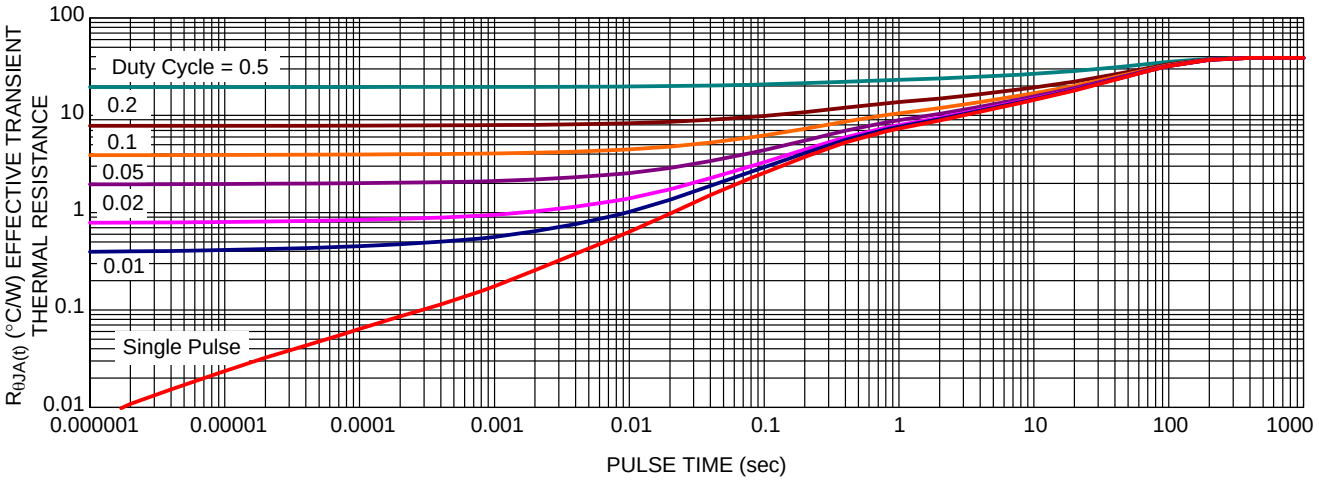



**Figure 13. Thermal Response**

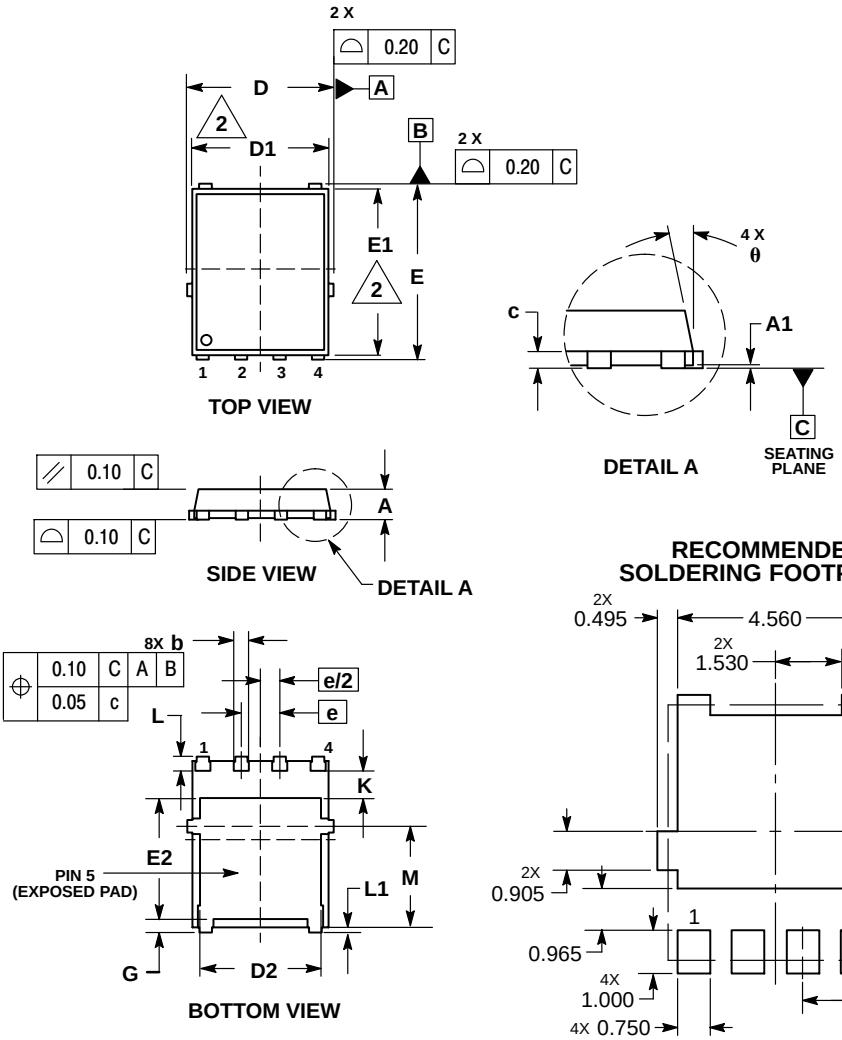
### DEVICE ORDERING INFORMATION

| Device | Marking | Package | Shipping† |
|---|---|---|---|
| NVMFS5113PLT1G | V5113L | DFN5<br>(Pb−Free) | 1500 / Tape & Reel |
| NVMFS5113PLWFT1G | 5113LW | DFN5<br>(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.

## PACKAGE DIMENSIONS

**DFN5 5x6, 1.27P**
**(SO−8FL)**
CASE 488AA
ISSUE M




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.

| | 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 | 4.70 | 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 ° |

STYLE 1:
PIN 1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN

**RECOMMENDED SOLDERING FOOTPRINT***




DIMENSIONS: 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.



### PUBLICATION ORDERING INFORMATION

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