

# NVMFD5877NL, NVMFD5877NLWF

## Power MOSFET

60 V, 39 mΩ, 17 A, Dual N-Channel, Logic Level, Dual SO8FL

### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- NVMFD5877NLWF – Wettable Flanks Product
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free and are RoHS Compliant

**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  | $V_{GS}$                                       | $\pm 20$   | V           |                  |
| Continuous Drain Current $R_{\Psi J-mb}$ (Notes 1, 2, 3, 4)   | Steady State                                   | $T_{mb} = 25^\circ\text{C}$                        | 17          | A                |
|   |  | $T_{mb} = 100^\circ\text{C}$                       | 12          |                  |
| Power Dissipation $R_{\Psi J-mb}$ (Notes 1, 2, 3)   | Steady State                                   | $T_{mb} = 25^\circ\text{C}$                        | 23          | W                |
|   |  | $T_{mb} = 100^\circ\text{C}$                       | 12          |                  |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1 & 3, 4)   | Steady State                                   | $T_A = 25^\circ\text{C}$                           | 6           | A                |
|   |  | $T_A = 100^\circ\text{C}$                          | 5           |                  |
| Power Dissipation $R_{\theta JA}$ (Notes 1, 3)  | Steady State                                   | $T_A = 25^\circ\text{C}$                           | 3.2         | W                |
|   |  | $T_A = 100^\circ\text{C}$                          | 1.6         |                  |
| Pulsed Drain Current  | $T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$ | $I_{DM}$   | 74          | A                |
| Operating Junction and Storage Temperature  |  | $T_J, T_{stg}$                                     | -55 to +175 | $^\circ\text{C}$ |
| Source Current (Body Diode)   |  | $I_S$  | 19          | A                |
| Single Pulse Drain-to-Source Avalanche Energy ( $T_J = 25^\circ\text{C}, V_{DD} = 24 \text{ V}, V_{GS} = 10 \text{ V}, R_G = 25 \Omega$ ) |  | $(I_{L(pk)} = 14.5 \text{ A}, L = 0.1 \text{ mH})$ | 10.5        | mJ               |
|   |  | $(I_{L(pk)} = 6.3 \text{ A}, L = 2 \text{ mH})$    | 40          |                  |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s)   |  | $T_L$  | 260         | $^\circ\text{C}$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

### THERMAL RESISTANCE MAXIMUM RATINGS (Note 1)

| Parameter   | Symbol          | Value | Unit                      |
|---|-----------------|-------|---------------------------|
| Junction-to-Mounting Board (top) – Steady State (Note 2, 3) | $R_{\Psi J-mb}$ | 6.5   | $^\circ\text{C}/\text{W}$ |
| Junction-to-Ambient – Steady State (Note 3)                 | $R_{\theta JA}$ | 47    |                           |

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. Psi ( $\Psi$ ) is used as required per JESD51-12 for packages in which substantially less than 100% of the heat flows to single case surface.
3. Surface-mounted on FR4 board using a 650 mm<sup>2</sup>, 2 oz. Cu pad.
4. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

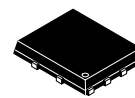
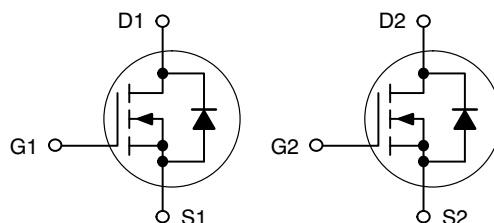


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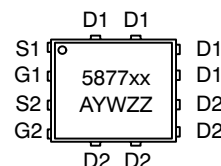
| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|---------------|------------------|-----------|
| 60 V          | 39 mΩ @ 10 V     | 17 A      |
|               | 60 mΩ @ 4.5 V    |           |

### Dual N-Channel



DFN8 5x6  
(SO8FL)  
CASE 506BT

### MARKING DIAGRAM



5877NL = Specific Device Code for NVMFD5877NL  
5877LW = Specific Device Code for NVMFD5877NLWF  
A = Assembly Location  
Y = Year  
W = Work Week  
ZZ = Lot Traceability

### ORDERING INFORMATION

| Device           | Package        | Shipping†          |
|------------------|----------------|--------------------|
| NVMFD5877NLT1G   | DFN8 (Pb-Free) | 1500 / Tape & Reel |
| NVMFD5877NLWFT1G | DFN8 (Pb-Free) | 1500 / Tape & Reel |
| NVMFD5877NLT3G   | DFN8 (Pb-Free) | 5000 / Tape & Reel |
| NVMFD5877NLWFT3G | DFN8 (Pb-Free) | 5000 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified)

| Parameter   | Symbol                               | Test Condition                                   | Min                    | Typ | Max  | Unit  |
|---|--------------------------------------|--|------------------------|-----|------|-------|
| <b>OFF CHARACTERISTICS</b>                                |                                      |  |                        |     |      |       |
| Drain-to-Source Breakdown Voltage                         | V <sub>(BR)DSS</sub>                 | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA   | 60                     |     |      | V     |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V <sub>(BR)DSS</sub> /T <sub>J</sub> |  |                        | 53  |      | mV/°C |
| Zero Gate Voltage Drain Current                           | I <sub>DSS</sub>                     | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 60 V | T <sub>J</sub> = 25°C  |     | 1.0  | μA    |
|   |                                      |  | T <sub>J</sub> = 125°C |     | 10   |       |
| Gate-to-Source Leakage Current                            | I <sub>GSS</sub>                     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V   |                        |     | ±100 | nA    |

## ON CHARACTERISTICS (Note 5)

|  |                                     |   |     |     |     |       |
|--|-------------------------------------|---|-----|-----|-----|-------|
| Gate Threshold Voltage                     | V <sub>GS(TH)</sub>                 | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA | 1.0 |     | 3.0 | V     |
| Negative Threshold Temperature Coefficient | V <sub>GS(TH)</sub> /T <sub>J</sub> |   |     | 3.5 |     | mV/°C |
| Drain-to-Source On Resistance              | R <sub>DS(on)</sub>                 | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 7.5 A              |     | 31  | 39  | mΩ    |
|  |                                     | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 7.5 A             |     | 42  | 60  |       |
| Forward Transconductance                   | g <sub>FS</sub>                     | V <sub>DS</sub> = 15 V, I <sub>D</sub> = 5.0 A              |     | 7.0 |     | S     |

## CHARGES AND CAPACITANCES

|                              |                     |  |  |      |    |    |
|------------------------------|---------------------|--|--|------|----|----|
| Input Capacitance            | C <sub>iss</sub>    | V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = 25 V                 |  | 540  |    | pF |
| Output Capacitance           | C <sub>oss</sub>    |  |  | 55   |    |    |
| Reverse Transfer Capacitance | C <sub>rss</sub>    |  |  | 36   |    |    |
| Total Gate Charge            | Q <sub>G(TOT)</sub> | V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 48 V,<br>I <sub>D</sub> = 5.0 A |  | 5.9  |    | nC |
| Threshold Gate Charge        | Q <sub>G(TH)</sub>  |  |  | 0.62 |    |    |
| Gate-to-Source Charge        | Q <sub>GS</sub>     |  |  | 1.64 |    |    |
| Gate-to-Drain Charge         | Q <sub>GD</sub>     |  |  | 2.80 |    |    |
| Total Gate Charge            | Q <sub>G(TOT)</sub> | V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 48V, I <sub>D</sub> = 5.0A       |  | 11   | 20 | nC |

## SWITCHING CHARACTERISTICS (Note 6)

|                     |                     |  |  |      |  |    |
|---------------------|---------------------|--|--|------|--|----|
| Turn-On Delay Time  | t <sub>d(on)</sub>  | V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 48 V,<br>I <sub>D</sub> = 5.0 A, R <sub>G</sub> = 2.5 Ω |  | 8.1  |  | ns |
| Rise Time           | t <sub>r</sub>      |  |  | 15.8 |  |    |
| Turn-Off Delay Time | t <sub>d(off)</sub> |  |  | 11.8 |  |    |
| Fall Time           | t <sub>f</sub>      |  |  | 3.9  |  |    |
| Turn-On Delay Time  | t <sub>d(on)</sub>  | V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 48 V,<br>I <sub>D</sub> = 5.0 A, R <sub>G</sub> = 2.5 Ω  |  | 4.9  |  | ns |
| Rise Time           | t <sub>r</sub>      |  |  | 6.4  |  |    |
| Turn-Off Delay Time | t <sub>d(off)</sub> |  |  | 14.5 |  |    |
| Fall Time           | t <sub>f</sub>      |  |  | 2.4  |  |    |

## DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |                 |  |                        |      |     |     |    |
|-------------------------|-----------------|--|------------------------|------|-----|-----|----|
| Forward Diode Voltage   | V <sub>SD</sub> | V <sub>GS</sub> = 0 V,<br>I <sub>S</sub> = 5.0 A   | T <sub>J</sub> = 25°C  |      | 0.8 | 1.2 | V  |
|                         |                 |  | T <sub>J</sub> = 125°C |      | 0.7 |     |    |
| Reverse Recovery Time   | t <sub>RR</sub> | V <sub>GS</sub> = 0 V, d <sub>IS</sub> /d <sub>t</sub> = 100 A/μs,<br>I <sub>S</sub> = 5.0 A |                        | 14.5 |     | ns  |    |
| Charge Time             | t <sub>a</sub>  |  |                        | 11.5 |     |     |    |
| Discharge Time          | t <sub>b</sub>  |  |                        | 3.1  |     |     |    |
| Reverse Recovery Charge | Q <sub>RR</sub> |  |                        | 11   |     |     | nC |

## PACKAGE PARASITIC VALUES

|                   |                |                       |  |       |  |    |
|-------------------|----------------|-----------------------|--|-------|--|----|
| Source Inductance | L <sub>S</sub> | T <sub>A</sub> = 25°C |  | 0.93  |  | nH |
| Drain Inductance  | L <sub>D</sub> |                       |  | 0.005 |  |    |
| Gate Inductance   | L <sub>G</sub> |                       |  | 1.84  |  |    |
| Gate Resistance   | R <sub>G</sub> |                       |  | 1.5   |  |    |

5. Pulse Test: pulse width = 300 μs, duty cycle ≤ 2%.

6. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

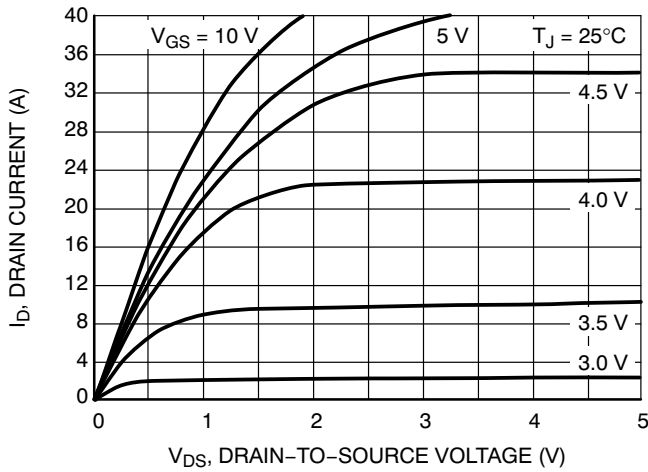


Figure 1. On-Region Characteristics

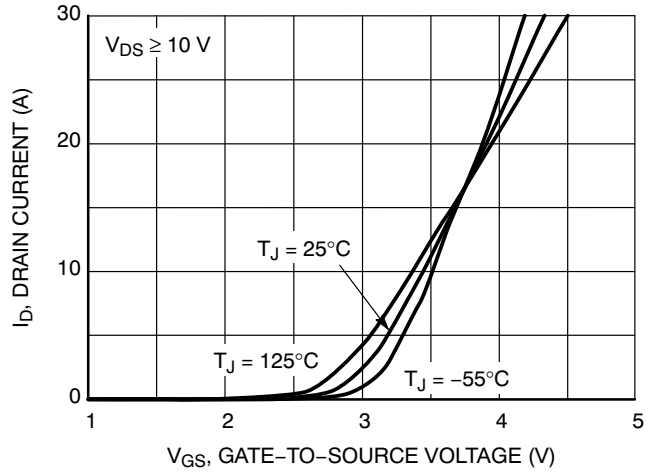


Figure 2. Transfer Characteristics

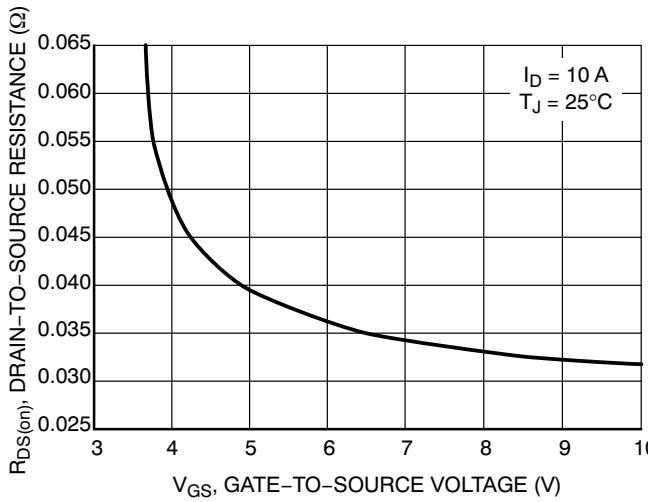


Figure 3. On-Resistance vs. Gate-to-Source Voltage

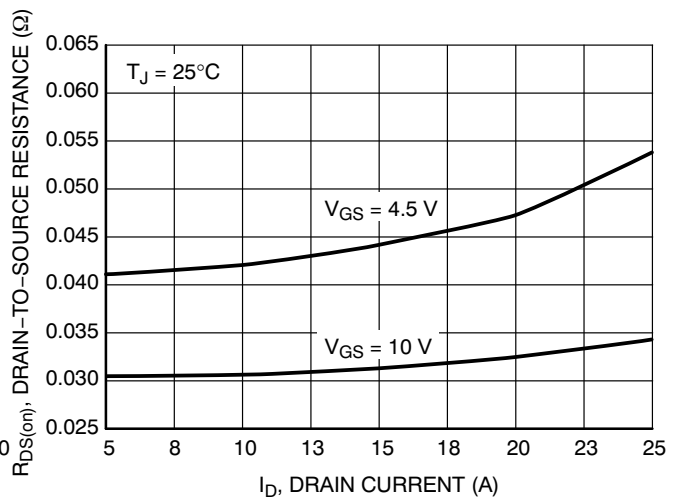


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

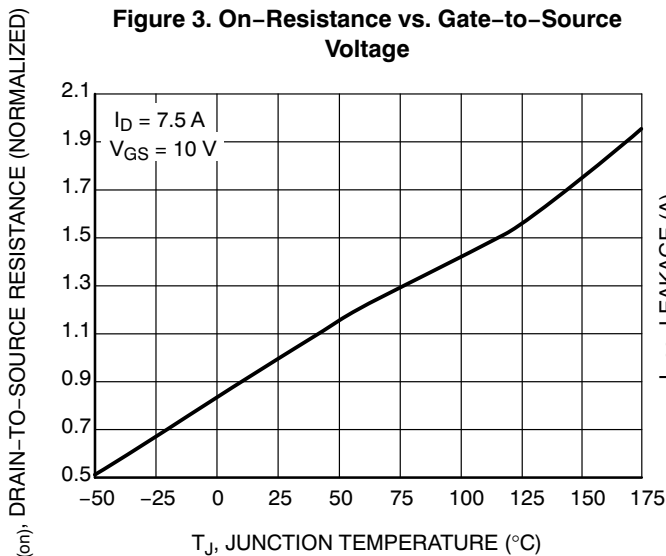


Figure 5. On-Resistance Variation with Temperature

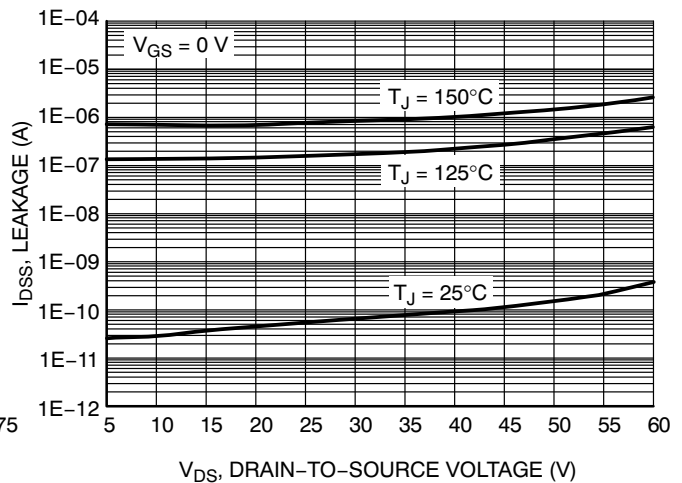


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

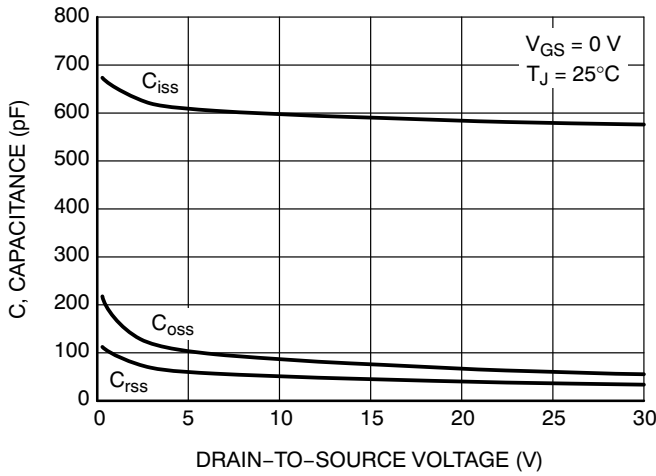


Figure 7. Capacitance Variation

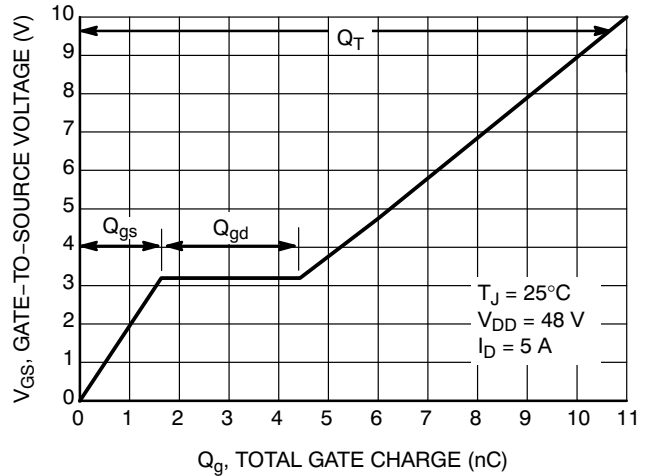


Figure 8. Gate-to-Source vs. Gate Charge

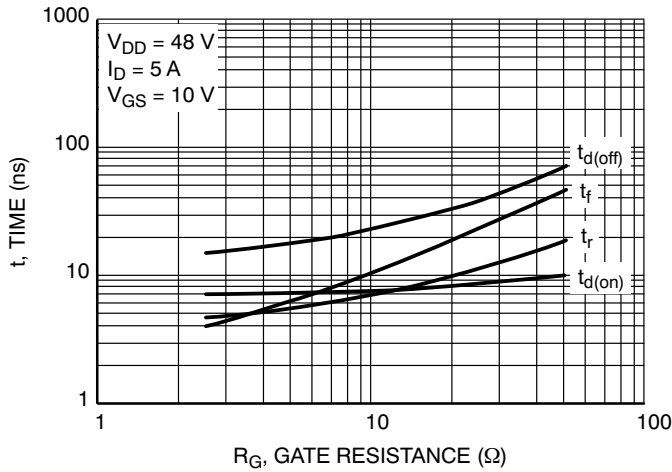


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

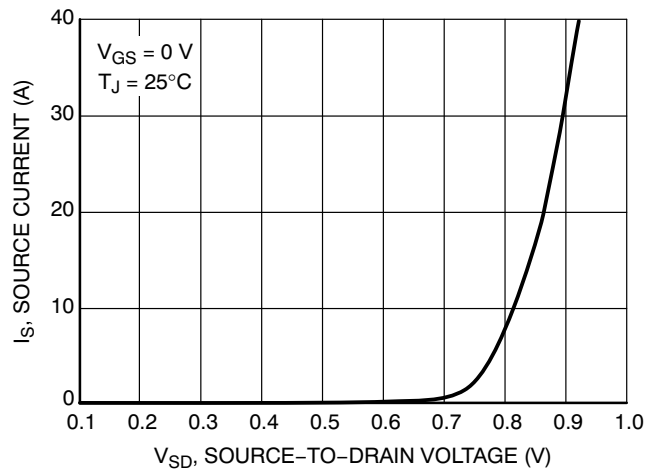


Figure 10. Diode Forward Voltage

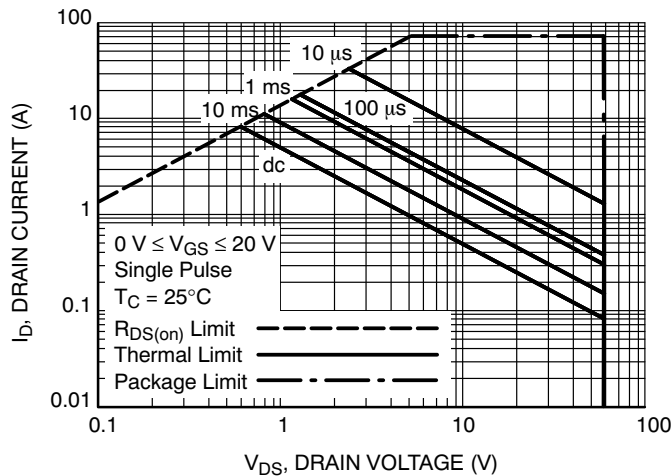


Figure 11. Maximum Rated Forward Biased Safe Operating Area

# NVMFD5877NL, NVMFD5877NLWF

## TYPICAL CHARACTERISTICS

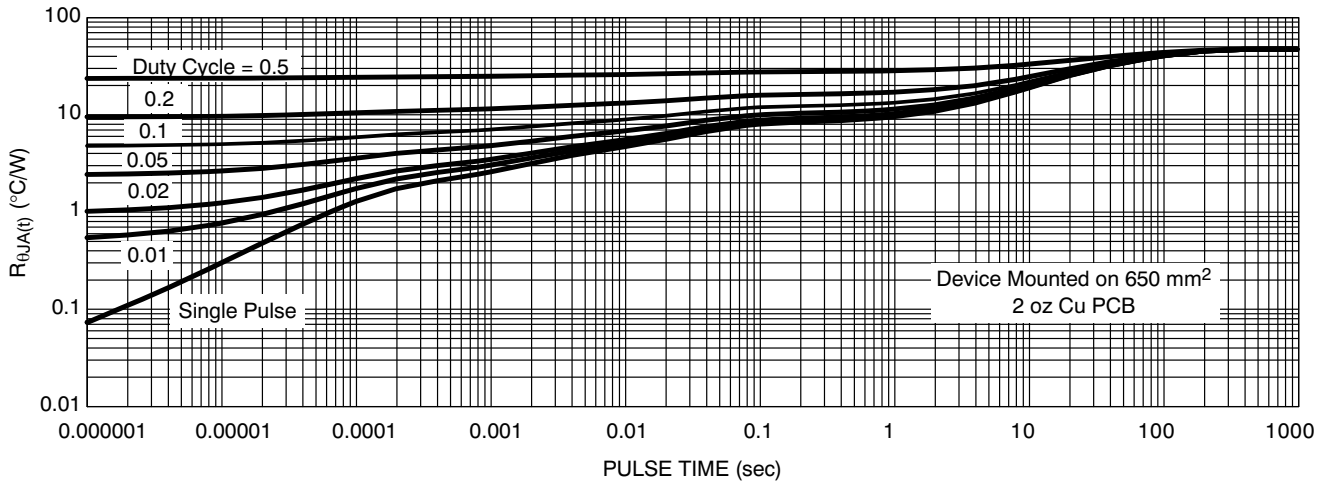
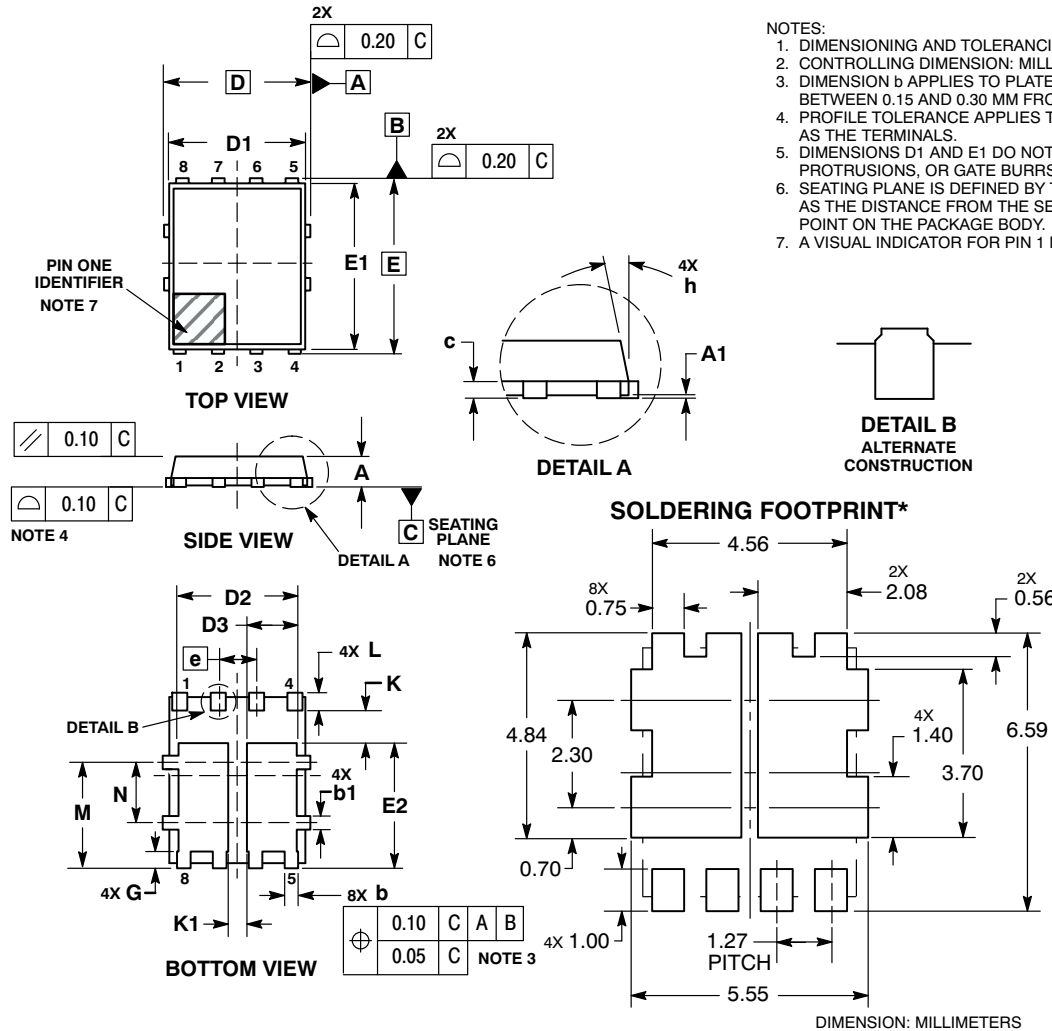


Figure 12. Thermal Response

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## PACKAGE DIMENSIONS

### DFN8 5x6, 1.27P Dual Flag (SO8FL-Dual) CASE 506BT ISSUE E



\*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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