

# NVD5117PL

## Power MOSFET

-60 V, 16 mΩ, -61 A, Single P-Channel

### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- High Current Capability
- Avalanche Energy Specified
- AEC-Q101 Qualified
- These Devices are Pb-Free, Halogen Free/BFR 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 $R_{\theta JC}$ (Note 1)   | Steady State                                   | $T_C = 25^\circ\text{C}$  | -61              | A |
|   |  | $T_C = 100^\circ\text{C}$ | -43              |   |
| Power Dissipation $R_{\theta JC}$ (Note 1)  | Steady State                                   | $T_C = 25^\circ\text{C}$  | 118              | W |
|   |  | $T_C = 100^\circ\text{C}$ | 59               |   |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1 & 2)  | Steady State                                   | $T_A = 25^\circ\text{C}$  | -11              | A |
|   |  | $T_A = 100^\circ\text{C}$ | -8               |   |
| Power Dissipation $R_{\theta JA}$ (Notes 1 & 2)   | Steady State                                   | $T_A = 25^\circ\text{C}$  | 4.1              | W |
|   |  | $T_A = 100^\circ\text{C}$ | 2.1              |   |
| Pulsed Drain Current  | $T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$ | $I_{DM}$                  | -419             | A |
| Current Limited by Package (Note 3)   | $T_A = 25^\circ\text{C}$                       | $I_{Dmaxpkg}$             | 60               | A |
| Operating Junction and Storage Temperature  | $T_J, T_{stg}$                                 | -55 to 175                | $^\circ\text{C}$ |   |
| Source Current (Body Diode)   | $I_S$  | -118                      | A                |   |
| Single Pulse Drain-to-Source Avalanche Energy ( $T_J = 25^\circ\text{C}, V_{DD} = 50 \text{ V}, V_{GS} = 10 \text{ V}, I_{L(pk)} = 40 \text{ A}, L = 0.3 \text{ mH}, R_G = 25 \Omega$ ) | $E_{AS}$                                       | 240                       | mJ               |   |
| Lead Temperature 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.

### THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter                                   | Symbol          | Value | Unit                      |
|---|-----------------|-------|---------------------------|
| Junction-to-Case - Steady State (Drain)     | $R_{\theta JC}$ | 1.3   | $^\circ\text{C}/\text{W}$ |
| Junction-to-Ambient - Steady State (Note 2) | $R_{\theta JA}$ | 37    |                           |

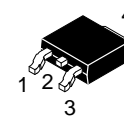
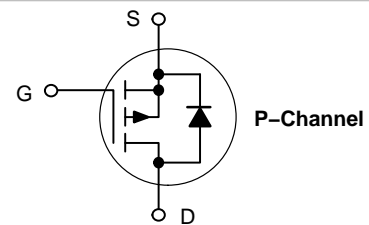
1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using a 650 mm<sup>2</sup>, 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is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



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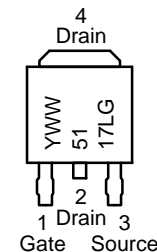
[www.onsemi.com](http://www.onsemi.com)

| $V_{(BR)DSS}$ | $R_{DS(on)}$   | $I_D$ |
|---------------|----------------|-------|
| -60 V         | 16 mΩ @ -10 V  | -61 A |
|               | 22 mΩ @ -4.5 V |       |



DPAK  
CASE 369C  
STYLE 2

### MARKING DIAGRAMS & PIN ASSIGNMENT



Y = Year  
WW = Work Week  
5117L = Device Code  
G = Pb-Free Package

### ORDERING INFORMATION

| Device       | Package           | Shipping†          |
|--------------|-------------------|--------------------|
| NVD5117PLT4G | DPAK<br>(Pb-Free) | 2500 / 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.

# NVD5117PL

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

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

### OFF CHARACTERISTICS

|                                   |                      |   |     |                        |      |      |
|-----------------------------------|----------------------|---|-----|------------------------|------|------|
| Drain-to-Source Breakdown Voltage | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0 V, I <sub>D</sub> = -250 μA   | -60 |                        |      | V    |
| 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 |
|                                   |                      |   |     | T <sub>J</sub> = 125°C |      | -100 |
| 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 4)

|                               |                     |  |      |  |      |    |
|-------------------------------|---------------------|--|------|--|------|----|
| Gate Threshold Voltage        | V <sub>GS(TH)</sub> | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = -250 μA | -1.5 |  | -2.5 | V  |
| Drain-to-Source On Resistance | R <sub>DS(on)</sub> | V <sub>GS</sub> = -10 V, I <sub>D</sub> = -29 A              |      |  | 12   | 16 |
|                               |                     |  |      |  | 16   | 22 |
| Forward Transconductance      | g <sub>FS</sub>     | V <sub>DS</sub> = -15 V, I <sub>D</sub> = -15 A              |      |  | 30   | S  |

### CHARGES AND CAPACITANCES

|                              |                     |  |  |                          |      |    |
|------------------------------|---------------------|--|--|--------------------------|------|----|
| Input Capacitance            | C <sub>iss</sub>    | V <sub>GS</sub> = 0 V, f = 1.0 MHz,<br>V <sub>DS</sub> = -25 V               |  |                          | 4800 | pF |
| Output Capacitance           | C <sub>oss</sub>    |  |  |                          | 480  |    |
| Reverse Transfer Capacitance | C <sub>rss</sub>    |  |  |                          | 320  |    |
| Total Gate Charge            | Q <sub>G(TOT)</sub> | V <sub>DS</sub> = -48 V,<br>I <sub>D</sub> = -29 A                           |  | V <sub>GS</sub> = -4.5 V | 49   | nC |
|                              |                     |  |  | V <sub>GS</sub> = -10 V  | 85   |    |
| Threshold Gate Charge        | Q <sub>G(TH)</sub>  | V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -48 V,<br>I <sub>D</sub> = -29 A |  |                          | 3    |    |
| Gate-to-Source Charge        | Q <sub>GS</sub>     |  |  |                          | 13   |    |
| Gate-to-Drain Charge         | Q <sub>GD</sub>     |  |  |                          | 28   |    |
| Plateau Voltage              | V <sub>GP</sub>     |  |  |                          | 3.2  | V  |

### SWITCHING CHARACTERISTICS (Notes 4)

|                     |                     |  |  |  |     |    |
|---------------------|---------------------|--|--|--|-----|----|
| 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> = -29 A, R <sub>G</sub> = 2.5 Ω |  |  | 22  | ns |
| Rise Time           | t <sub>r</sub>      |  |  |  | 195 |    |
| Turn-Off Delay Time | t <sub>d(off)</sub> |  |  |  | 50  |    |
| Fall Time           | t <sub>f</sub>      |  |  |  | 132 |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |                 |  |  |                       |                        |       |    |
|-------------------------|-----------------|--|--|-----------------------|------------------------|-------|----|
| Forward Diode Voltage   | V <sub>SD</sub> | V <sub>GS</sub> = 0 V,<br>I <sub>S</sub> = -29 A                                 |  | T <sub>J</sub> = 25°C | -0.86                  | -1.0  | V  |
|                         |                 |  |  |                       | T <sub>J</sub> = 125°C | -0.74 |    |
| Reverse Recovery Time   | t <sub>RR</sub> | V <sub>GS</sub> = 0 V, di <sub>S</sub> /dt = 100 A/μs,<br>I <sub>S</sub> = -29 A |  |                       | 36                     |       | ns |
| Charge Time             | t <sub>a</sub>  |  |  |                       | 19                     |       |    |
| Discharge Time          | t <sub>b</sub>  |  |  |                       | 17                     |       |    |
| Reverse Recovery Charge | Q <sub>RR</sub> |  |  |                       | 44                     | 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

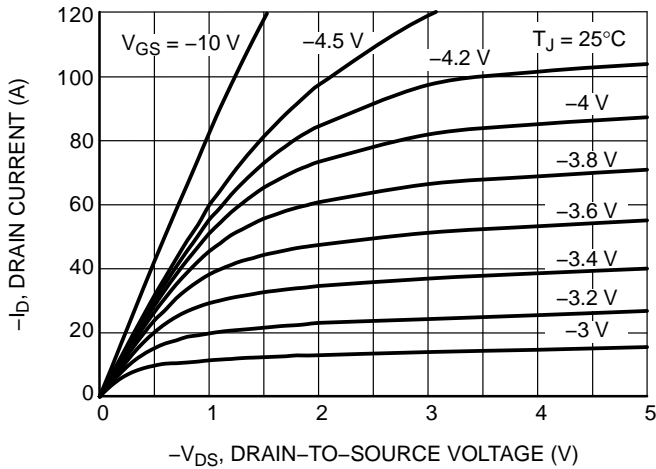


Figure 1. On-Region Characteristics

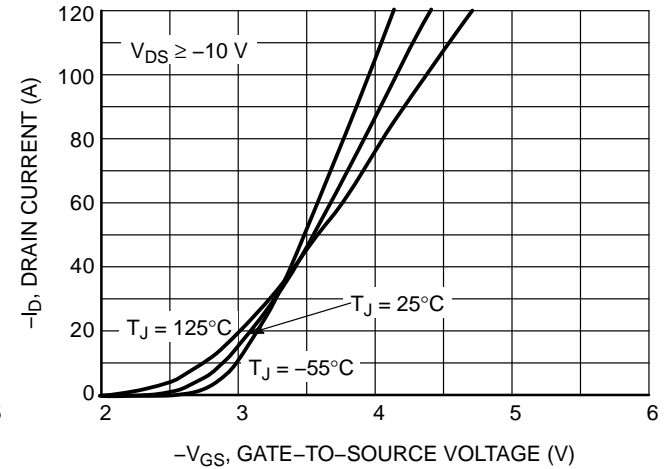


Figure 2. Transfer Characteristics

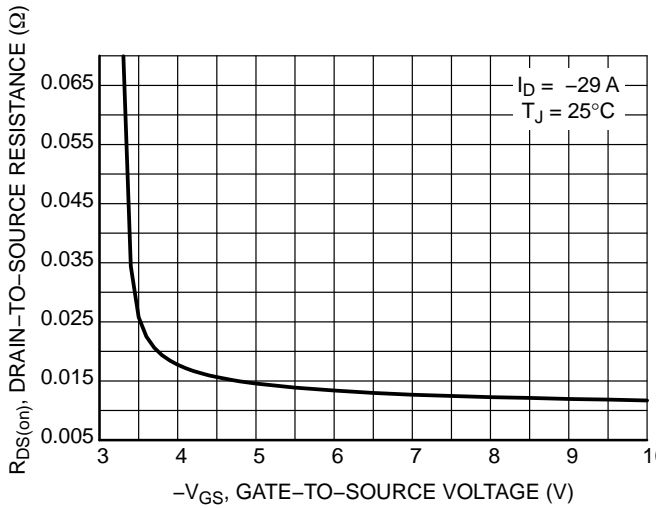


Figure 3. On-Resistance vs. Gate-to-Source Voltage

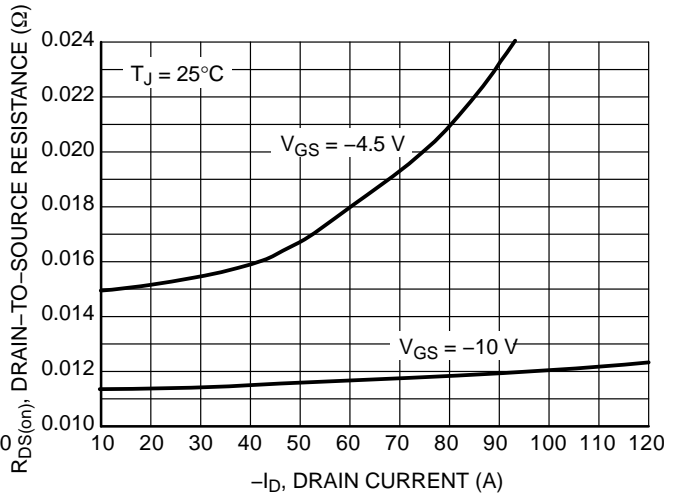


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

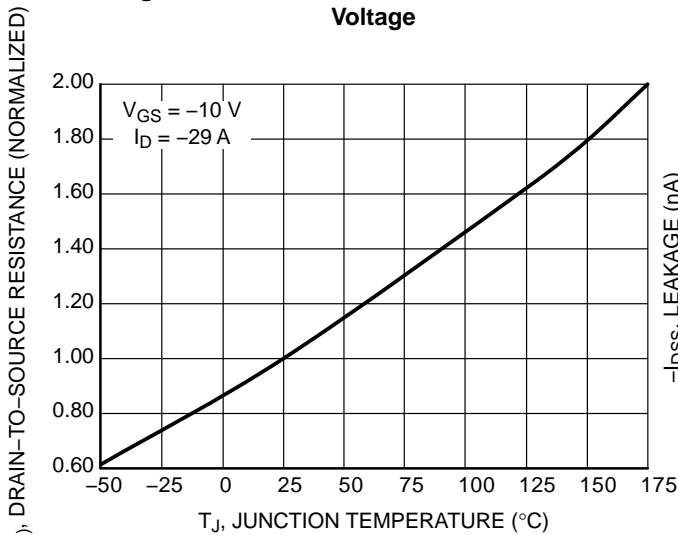


Figure 5. On-Resistance Variation with Temperature

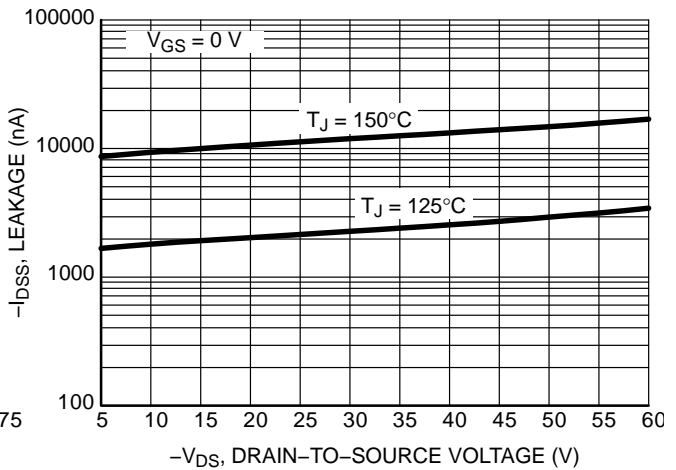


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NVD5117PL

## TYPICAL CHARACTERISTICS

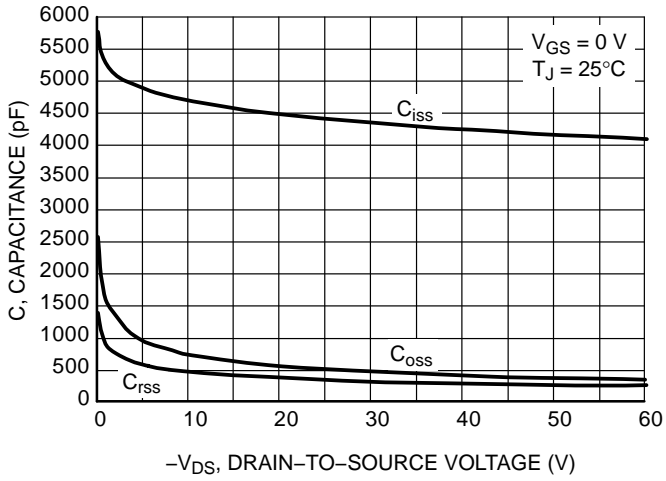


Figure 7. Capacitance Variation

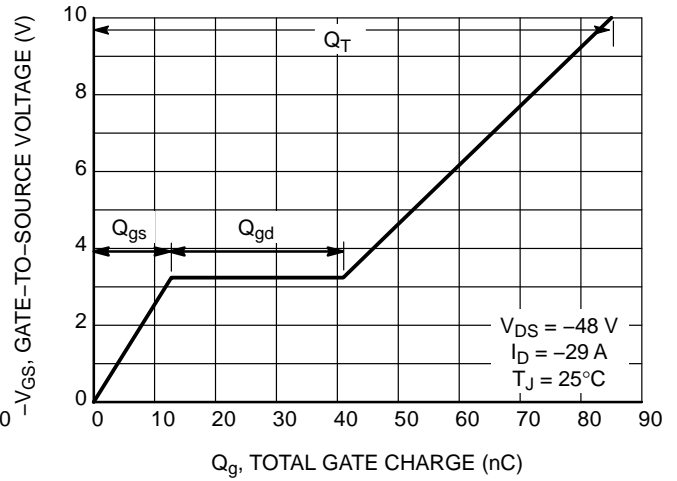


Figure 8. Gate-to-Source vs. Total Charge

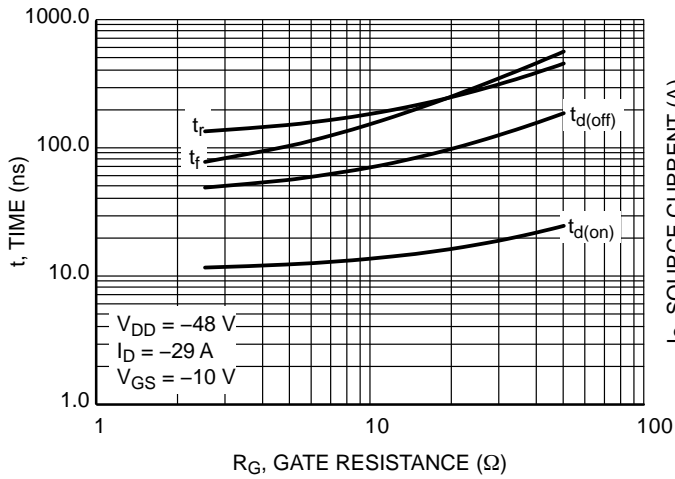


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

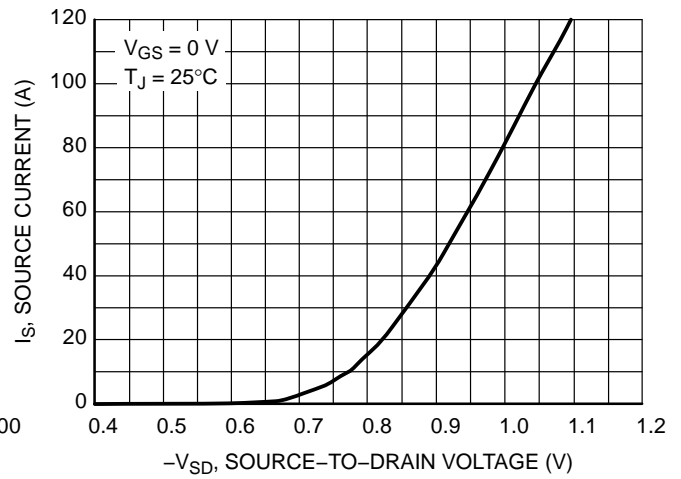


Figure 10. Diode Forward Voltage vs. Current

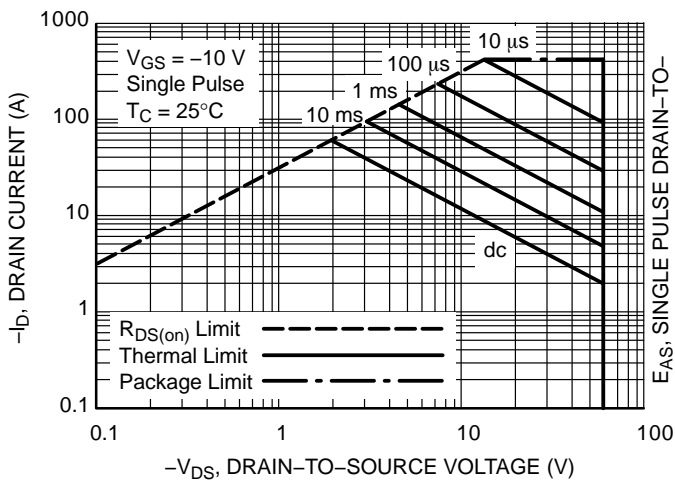


Figure 11. Maximum Rated Forward Biased Safe Operating Area

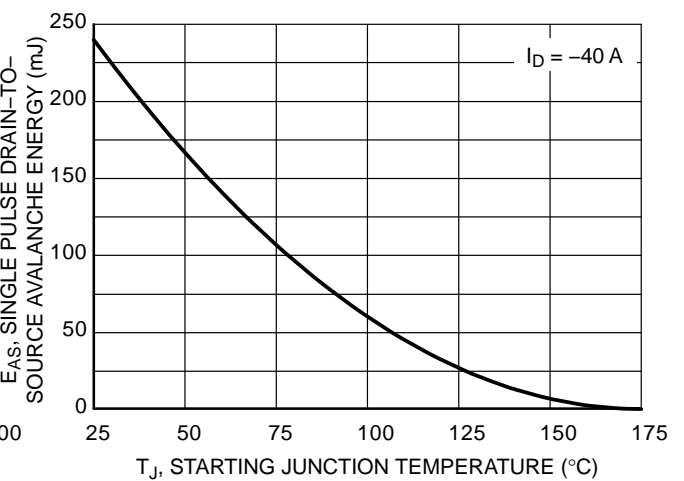


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

# NVD5117PL

## TYPICAL CHARACTERISTICS

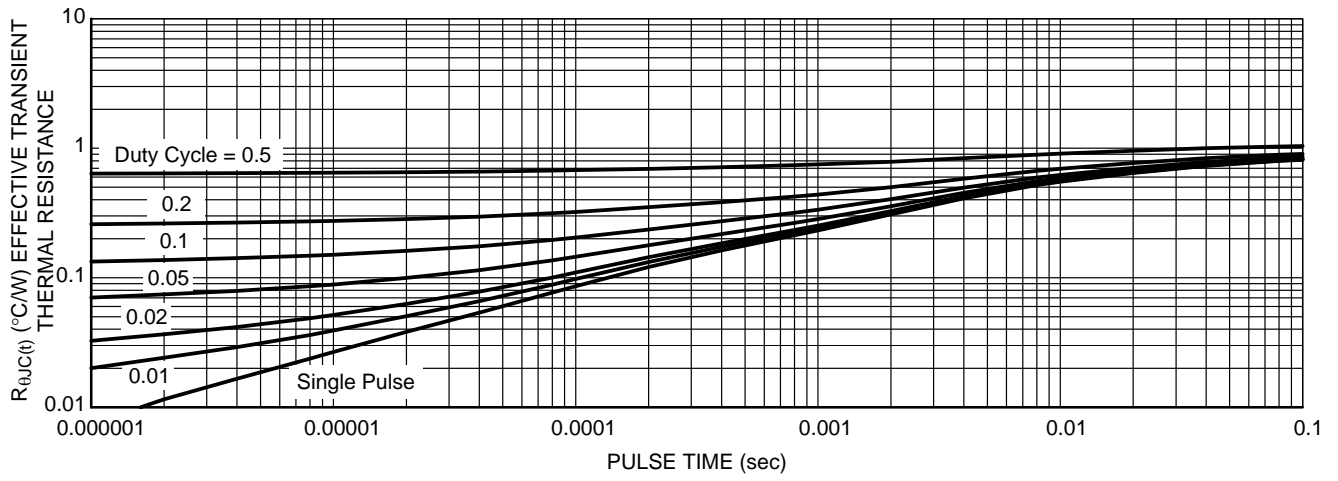
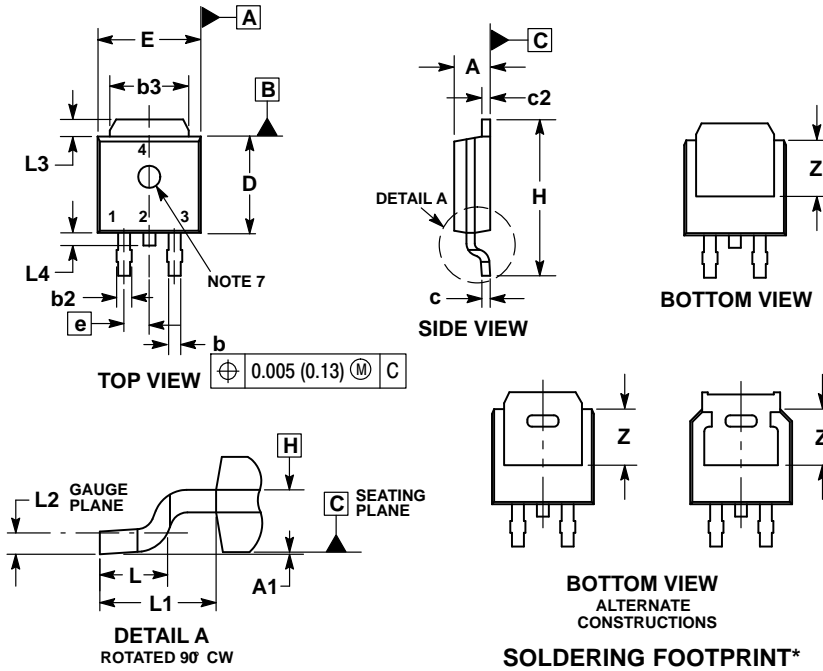


Figure 13. Thermal Response

# NVD5117PL

## PACKAGE DIMENSIONS

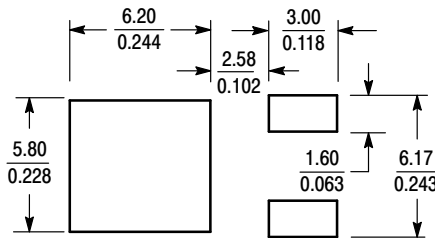
### DPAK (SINGLE GAUGE) CASE 369C ISSUE F



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
7. OPTIONAL MOLD FEATURE.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.086     | 0.094 | 2.18        | 2.38  |
| A1  | 0.000     | 0.005 | 0.00        | 0.13  |
| b   | 0.025     | 0.035 | 0.63        | 0.89  |
| b2  | 0.028     | 0.045 | 0.72        | 1.14  |
| b3  | 0.180     | 0.215 | 4.57        | 5.46  |
| c   | 0.018     | 0.024 | 0.46        | 0.61  |
| c2  | 0.018     | 0.024 | 0.46        | 0.61  |
| D   | 0.235     | 0.245 | 5.97        | 6.22  |
| E   | 0.250     | 0.265 | 6.35        | 6.73  |
| e   | 0.090 BSC |       | 2.29 BSC    |       |
| H   | 0.370     | 0.410 | 9.40        | 10.41 |
| L   | 0.055     | 0.070 | 1.40        | 1.78  |
| L1  | 0.114 REF |       | 2.90 REF    |       |
| L2  | 0.020 BSC |       | 0.51 BSC    |       |
| L3  | 0.035     | 0.050 | 0.89        | 1.27  |
| L4  | ---       | 0.040 | ---         | 1.01  |
| Z   | 0.155     | ---   | 3.93        | ---   |



SCALE 3:1  $\left( \frac{\text{mm}}{\text{inches}} \right)$

\*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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