

NDD60N900U1

N-Channel Power MOSFET 600 V, 900 mΩ



ON Semiconductor®

<http://onsemi.com>

Features

- 100% Avalanche Tested
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

ABSOLUTE MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

| Parameter | | Symbol | Value | Unit | |
|--|------------------------|-----------------------------------|------------------------|------|---|
| Drain-to-Source Voltage | | V _{DSS} | 600 | V | |
| Gate-to-Source Voltage | | V _{GS} | ±25 | V | |
| Continuous Drain Current R _{θJC} | Steady State | I _D | T _C = 25°C | 5.7 | A |
| | | | T _C = 100°C | 3.6 | |
| Power Dissipation - R _{θJC} | Steady State | P _D | 74 | W | |
| | | T _C = 25°C | | | |
| Pulsed Drain Current | t _p = 10 μs | I _{DM} | 20 | A | |
| Operating Junction and Storage Temperature | | T _J , T _{STG} | -55 to +150 | °C | |
| Source Current (Body Diode) | | I _S | 5.7 | A | |
| Single Pulse Drain-to-Source Avalanche Energy (I _D = 2 A) | | EAS | 33 | mJ | |
| Peak Diode Recovery (Note 1) | | dv/dt | 15 | V/ns | |
| Lead Temperature for Soldering Leads | | 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.

1. I_{SD} < 5.7 A, di/dt ≤ 400 A/μs, V_{peak} < V_{(BR)DSS}

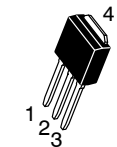
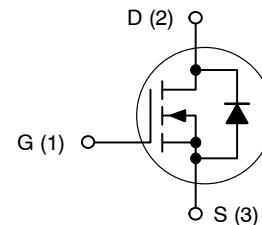
THERMAL RESISTANCE

| Parameter | Symbol | Value | Unit |
|---|------------------|-------------------------|------|
| Junction-to-Case (Drain) NDD60N900U1 | R _{θJC} | 1.7 | °C/W |
| Junction-to-Ambient Steady State (Note 3) | R _{θJA} | NDD60N900U1 | 47 |
| | | (Note 2) NDD60N900U1-1 | 99 |
| | | (Note 2) NDD60N900U1-35 | 95 |

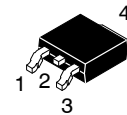
2. Insertion mounted
3. Surface mounted on FR4 board using 1" sq. pad size (Cu area = 1.127 in sq [2 oz] including traces)

| V _{(BR)DSS} | R _{DS(ON) MAX} |
|----------------------|-------------------------|
| 600 V | 900 mΩ @ 10 V |

N-Channel MOSFET



IPAK
CASE 369D
STYLE 2



DPAK
CASE 369C
STYLE 2



IPAK
CASE 369AD
STYLE 2

ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

NDD60N900U1

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

| Characteristic | Symbol | Test Conditions | Min | Typ | Max | Unit |
|----------------|--------|-----------------|-----|-----|-----|------|
|----------------|--------|-----------------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | | |
|---|--------------------------------------|--|------------------------|-----|------|-------|
| Drain-to-Source Breakdown Voltage | V _{(BR)DSS} | V _{GS} = 0 V, I _D = 1 mA | 600 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V _{(BR)DSS} /T _J | | | 550 | | mV/°C |
| Drain-to-Source Leakage Current | I _{DSS} | V _{DS} = 600 V, V _{GS} = 0 V | T _J = 25°C | | 1 | μA |
| | | | T _J = 125°C | | 100 | |
| Gate-to-Source Leakage Current | I _{GSS} | V _{GS} = ±20 V | | | ±100 | nA |

ON CHARACTERISTICS (Note 4)

| | | | | | | |
|--|-------------------------------------|---|---|-----|-----|-------|
| Gate Threshold Voltage | V _{GS(TH)} | V _{DS} = V _{GS} , I _D = 250 μA | 2 | 3.2 | 4 | V |
| Negative Threshold Temperature Coefficient | V _{GS(TH)} /T _J | Reference to 25°C, I _D = 250 μA | | 7.2 | | mV/°C |
| Static Drain-to-Source On Resistance | R _{DS(on)} | V _{GS} = 10 V, I _D = 2.5 A | | 820 | 900 | mΩ |
| Forward Transconductance | g _{FS} | V _{DS} = 15 V, I _D = 2.5 A | | 4.3 | | S |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|---|--------------------|---|--|-----|--|----|
| Input Capacitance | C _{iss} | V _{DS} = 50 V, V _{GS} = 0 V, f = 1 MHz | | 360 | | pF |
| Output Capacitance | C _{oss} | | | 23 | | |
| Reverse Transfer Capacitance | C _{rss} | | | 1.1 | | |
| Effective output capacitance, energy related (Note 6) | C _{o(er)} | V _{GS} = 0 V, V _{DS} = 0 to 480 V | | 17 | | |
| Effective output capacitance, time related (Note 7) | C _{o(tr)} | I _D = constant, V _{GS} = 0 V, V _{DS} = 0 to 480 V | | 57 | | |
| Total Gate Charge | Q _g | V _{DS} = 300 V, I _D = 5.9 A, V _{GS} = 10 V | | 12 | | nC |
| Gate-to-Source Charge | Q _{gs} | | | 2.5 | | |
| Gate-to-Drain ("Miller") Charge | Q _{gd} | | | 5.8 | | |
| Plateau Voltage | V _{GP} | | | 5.4 | | V |
| Gate Resistance | R _g | | | 5 | | Ω |

RESISTIVE SWITCHING CHARACTERISTICS (Note 5)

| | | | | | | |
|---------------------|---------------------|--|--|----|--|----|
| Turn-on Delay Time | t _{d(on)} | V _{DD} = 300 V, I _D = 5.9 A, V _{GS} = 10 V, R _G = 0 Ω | | 7 | | ns |
| Rise Time | t _r | | | 9 | | |
| Turn-off Delay Time | t _{d(off)} | | | 17 | | |
| Fall Time | t _f | | | 6 | | |

SOURCE-DRAIN DIODE CHARACTERISTICS

| | | | | | | |
|-------------------------|-----------------|--|------------------------|------|-----|----|
| Diode Forward Voltage | V _{SD} | I _S = 5.7 A, V _{GS} = 0 V | T _J = 25°C | 0.88 | 1.3 | V |
| | | | T _J = 100°C | 0.80 | | |
| Reverse Recovery Time | t _{rr} | V _{GS} = 0 V, V _{DD} = 30 V I _S = 5.9 A, d _i /d _t = 100 A/μs | | 270 | | ns |
| Charge Time | t _a | | | 130 | | |
| Discharge Time | t _b | | | 140 | | |
| Reverse Recovery Charge | Q _{rr} | | | 1.8 | | |

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 Width ≤ 300 μs, Duty Cycle ≤ 2%.

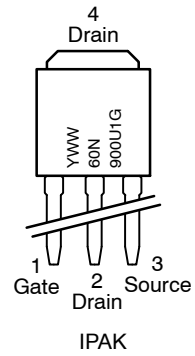
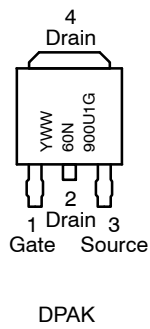
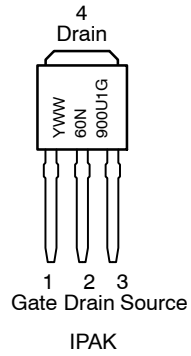
5. Switching characteristics are independent of operating junction temperatures.

6. C_{o(er)} is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{(BR)DSS}

7. C_{o(tr)} is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{(BR)DSS}

NDD60N900U1

MARKING DIAGRAMS



Y = Year
 WW = Work Week
 G = Pb-Free Package

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|-----------------|---------------------------------|-----------------------|
| NDD60N900U1-1G | IPAK (Pb-Free, Halogen-Free) | 75 Units / Rail |
| NDD60N900U1-35G | IPAK (Pb-Free, Halogen-Free) | 75 Units / Rail |
| NDD60N900U1T4G | DPAK (Pb-Free, Halogen-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.

TYPICAL CHARACTERISTICS

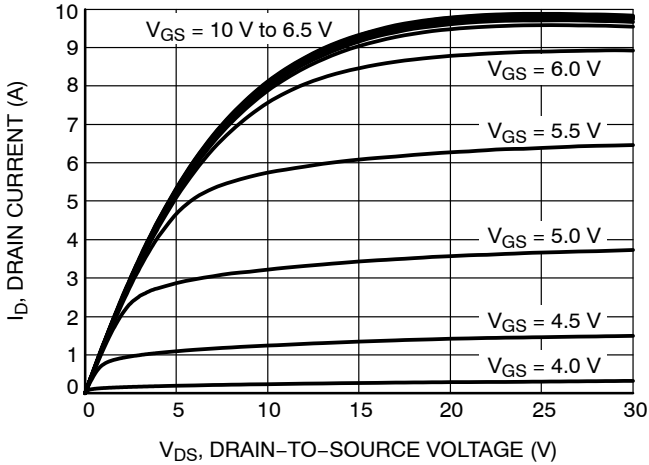


Figure 1. On-Region Characteristics

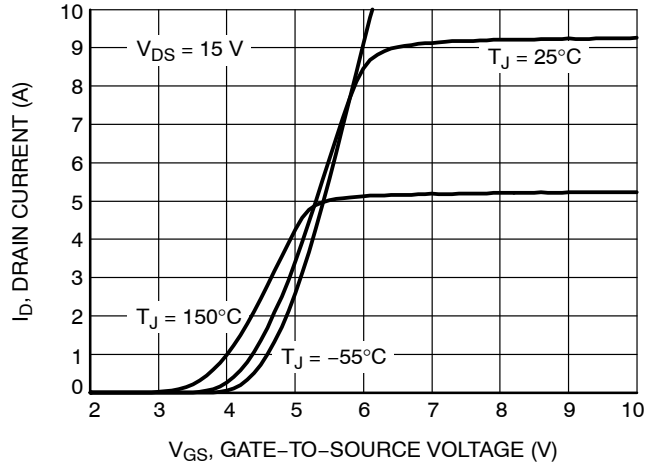


Figure 2. Transfer Characteristics

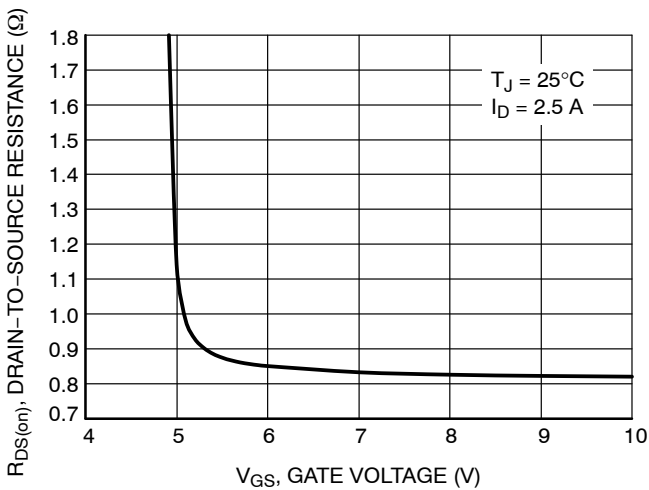


Figure 3. On-Resistance vs. Gate-to-Source Voltage

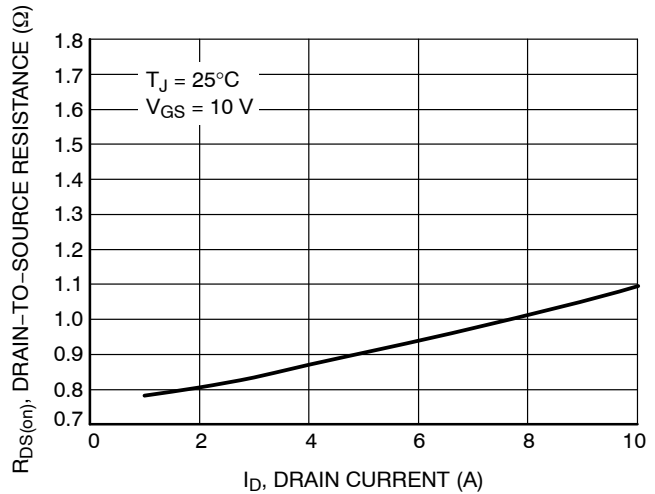


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

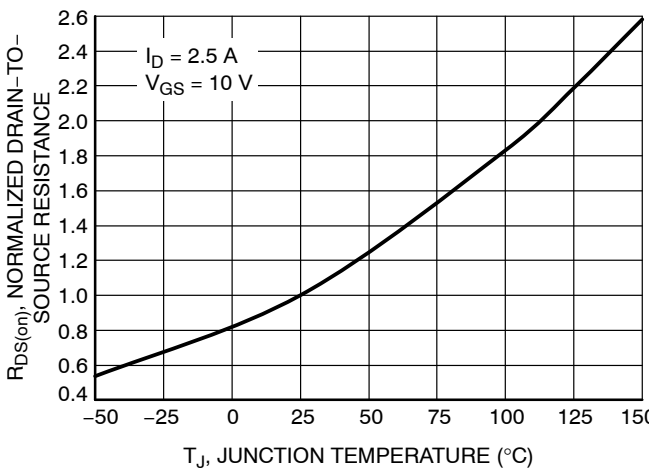


Figure 5. On-Resistance Variation with Temperature

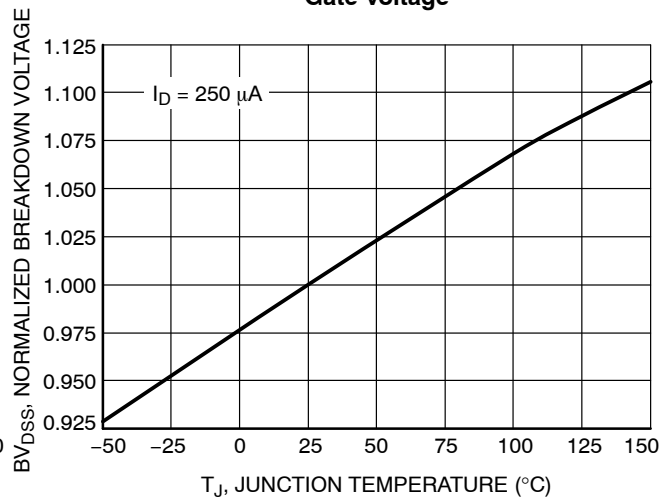


Figure 6. Breakdown Voltage Variation with Temperature

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TYPICAL CHARACTERISTICS

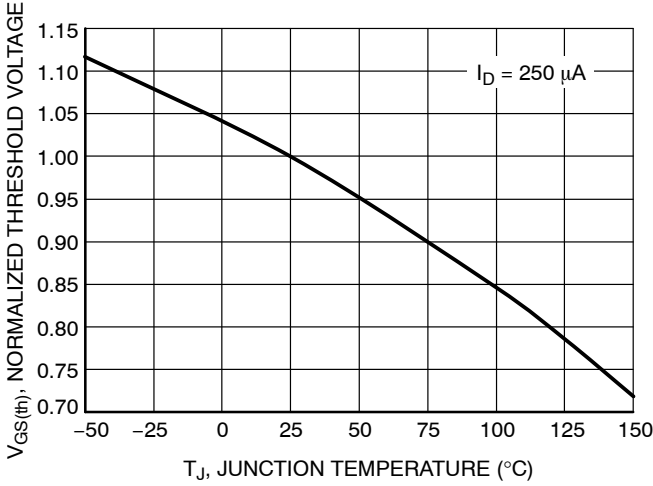


Figure 7. Threshold Voltage Variation with Temperature

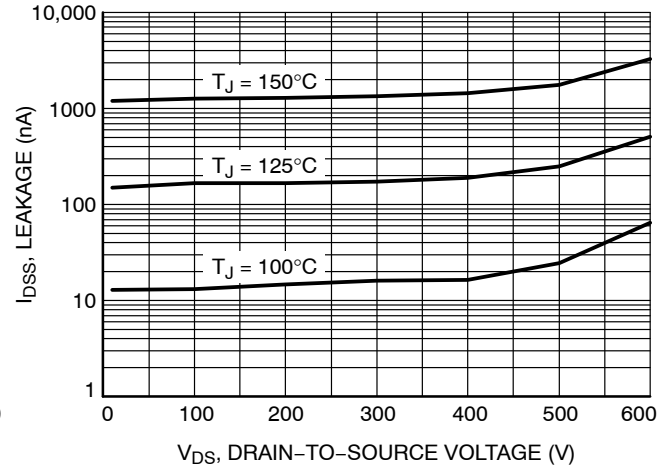


Figure 8. Drain-to-Source Leakage Current vs. Voltage

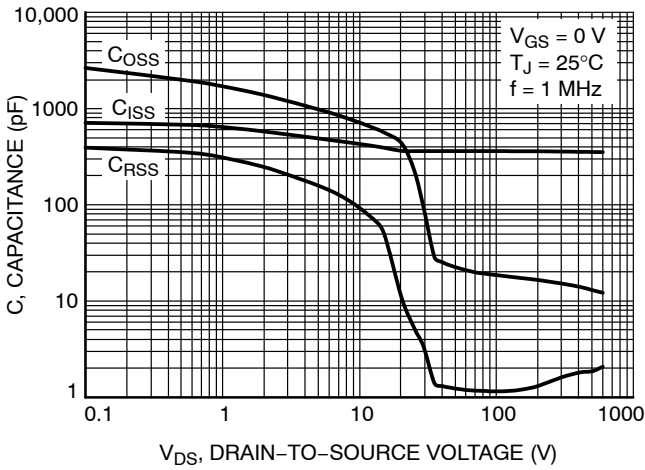


Figure 9. Capacitance Variation

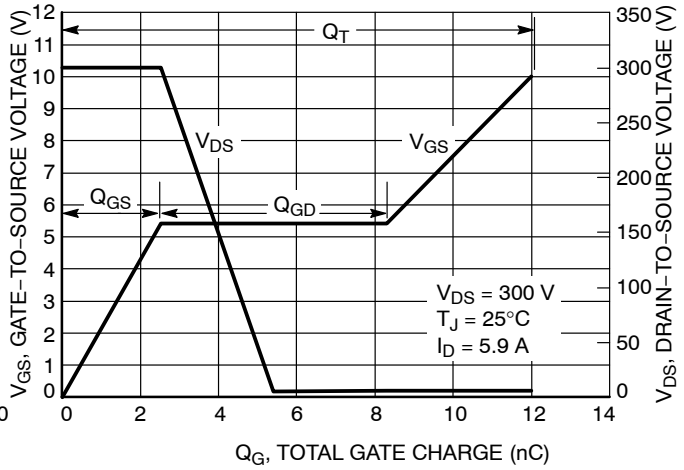


Figure 10. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

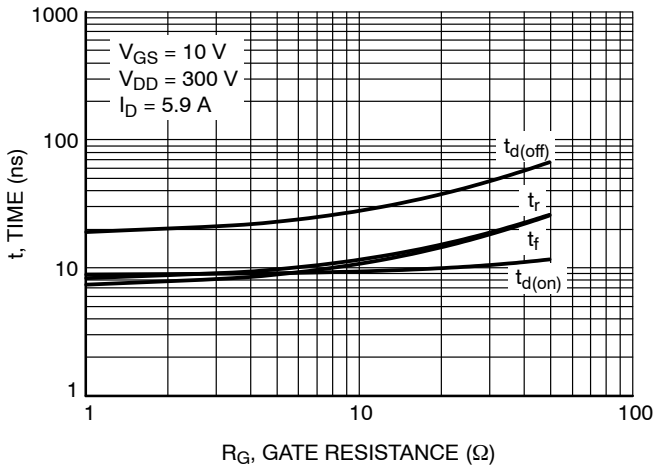


Figure 11. Resistive Switching Time Variation vs. Gate Resistance

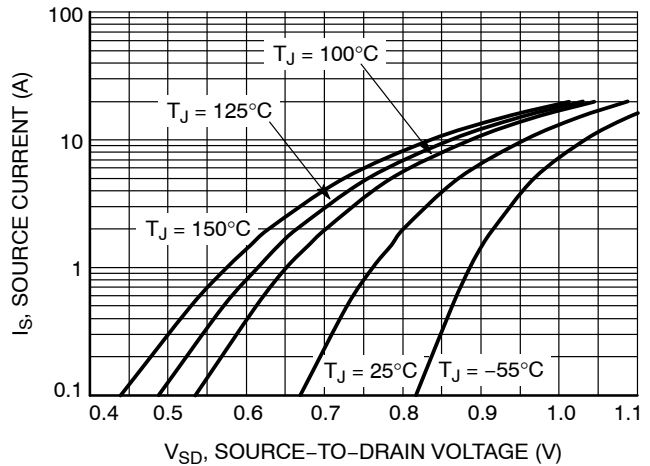


Figure 12. Diode Forward Voltage vs. Current

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TYPICAL CHARACTERISTICS

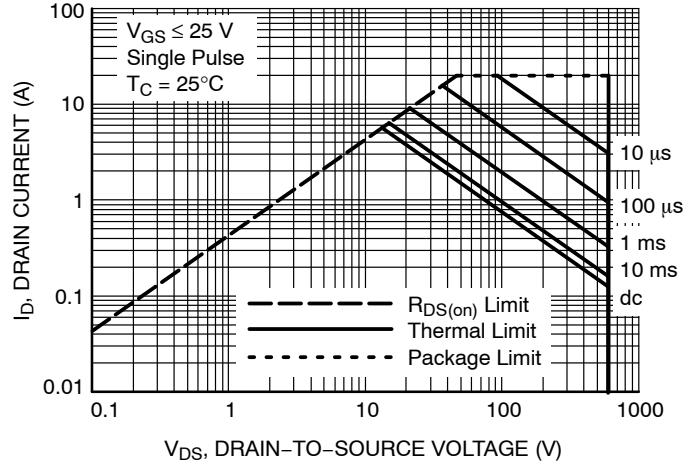


Figure 13. Maximum Rated Forward Biased Safe Operating Area

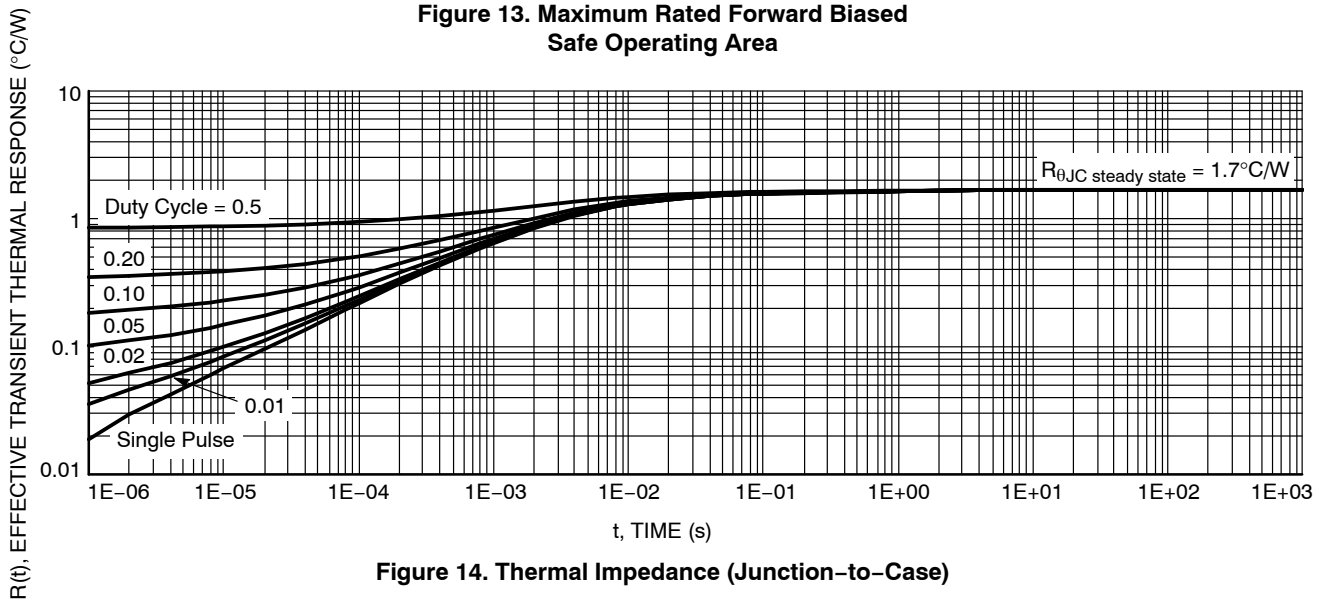
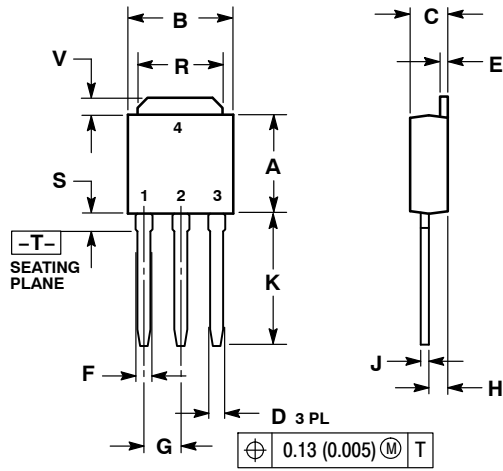


Figure 14. Thermal Impedance (Junction-to-Case)

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PACKAGE DIMENSIONS

IPAK CASE 369D-01 ISSUE C

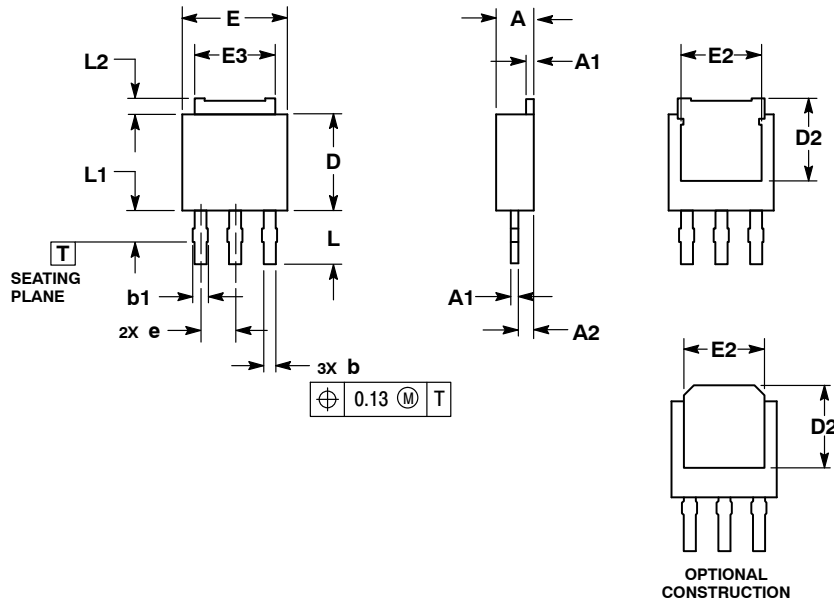


- NOTES:
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 - CONTROLLING DIMENSION: INCH.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|------|
| | MIN | MAX | MIN | MAX |
| A | 0.235 | 0.245 | 5.97 | 6.35 |
| B | 0.250 | 0.265 | 6.35 | 6.73 |
| C | 0.086 | 0.094 | 2.19 | 2.38 |
| D | 0.027 | 0.035 | 0.69 | 0.88 |
| E | 0.018 | 0.023 | 0.46 | 0.58 |
| F | 0.037 | 0.045 | 0.94 | 1.14 |
| G | 0.090 BSC | | 2.29 BSC | |
| H | 0.034 | 0.040 | 0.87 | 1.01 |
| J | 0.018 | 0.023 | 0.46 | 0.58 |
| K | 0.350 | 0.380 | 8.89 | 9.65 |
| R | 0.180 | 0.215 | 4.45 | 5.45 |
| S | 0.025 | 0.040 | 0.63 | 1.01 |
| V | 0.035 | 0.050 | 0.89 | 1.27 |
| Z | 0.155 | --- | 3.93 | --- |

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

3.5 MM IPAK, STRAIGHT LEAD CASE 369AD ISSUE B



- NOTES:
- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
 - CONTROLLING DIMENSION: MILLIMETERS.
 - DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30mm FROM TERMINAL TIP.
 - DIMENSIONS D AND E DO NOT INCLUDE MOLD GATE OR MOLD FLASH.

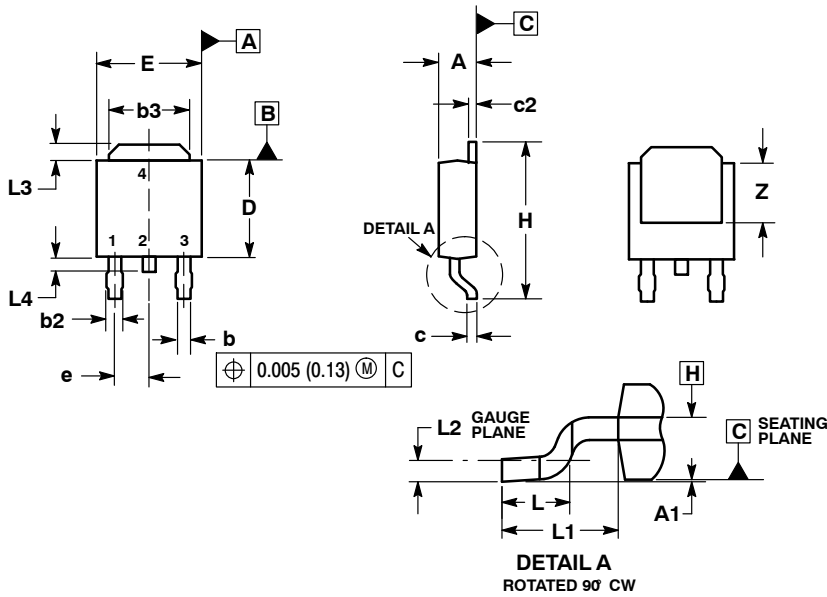
| DIM | MILLIMETERS | |
|-----|-------------|------|
| | MIN | MAX |
| A | 2.19 | 2.38 |
| A1 | 0.46 | 0.60 |
| A2 | 0.87 | 1.10 |
| b | 0.69 | 0.89 |
| b1 | 0.77 | 1.10 |
| D | 5.97 | 6.22 |
| D2 | 4.80 | --- |
| E | 6.35 | 6.73 |
| E2 | 4.57 | 5.45 |
| E3 | 4.45 | 5.46 |
| e | 2.28 BSC | |
| L | 3.40 | 3.60 |
| L1 | --- | 2.10 |
| L2 | 0.89 | 1.27 |

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

NDD60N900U1

PACKAGE DIMENSIONS

DPAK (SINGLE GAUGE) CASE 369C ISSUE D

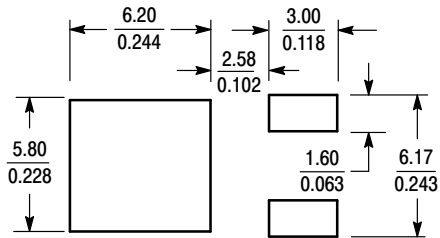


NOTES:

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.

| 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 | 0.030 | 0.045 | 0.76 | 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 | 0.108 REF | | 2.74 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 | --- |

SOLDERING FOOTPRINT*



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

STYLE 2:

1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

*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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