

NTD5804N, NTDV5804N

Power MOSFET

40 V, 69 A, Single N-Channel, DPAK/IPAK

Features

- Low $R_{DS(on)}$
- High Current Capability
- Avalanche Energy Specified
- AEC-Q101 Qualified and PPAP Capable – NTDV5804N
- These Devices are Pb-Free and are RoHS Compliant

Applications

- CCFL Backlight
- DC Motor Control
- Class D Amplifier
- Power Supply Secondary Side Synchronous Rectification

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

| Parameter | | | Symbol | Value | Unit |
|--|------------------------|------------------------|-----------------------------------|------------|------|
| Drain-to-Source Voltage | | | V _{DSS} | 40 | V |
| Gate-to-Source Voltage – Continuous | | | V _{GS} | ± 20 | V |
| Gate-to-Source Voltage – Non-Repetitive (t _p < 10 μs) | | | V _{GS} | ± 30 | V |
| Continuous Drain Current (R _{θJC}) (Note 1) | Steady State | T _C = 25°C | I _D | 69 | A |
| | | T _C = 100°C | | 49 | |
| Power Dissipation (R _{θJC}) (Note 1) | | T _C = 25°C | P _D | 71 | W |
| Pulsed Drain Current | t _p = 10 μs | | I _{DM} | 125 | A |
| Operating Junction and Storage Temperature | | | T _J , T _{stg} | –55 to 175 | °C |
| Source Current (Body Diode) | | | I _S | 60 | A |
| Single Pulse Drain-to-Source Avalanche Energy (V _{DD} = 50 V, V _{GS} = 10 V, R _G = 25 Ω, I _{L(pk)} = 36 A, L = 0.3 mH, V _{DS} = 40 V) | | | E _{AS} | 195 | mJ |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | | | T _L | 260 | °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

| Parameter | Symbol | Value | Unit |
|---|-----------------|-------|---------------------------|
| Junction-to-Case (Drain) | $R_{\theta JC}$ | 2.1 | $^\circ\text{C}/\text{W}$ |
| Junction-to-Ambient – Steady State (Note 1) | $R_{\theta JA}$ | 106 | |

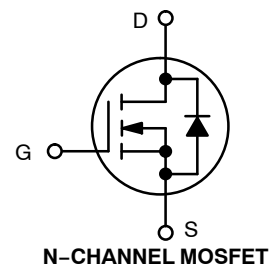
1. Surface-mounted on FR4 board using the minimum recommended pad size.



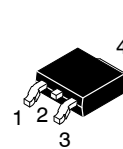
ON Semiconductor®

<http://onsemi.com>

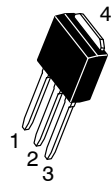
| $V_{(BR)DS}$ | $R_{DS(on)}$ MAX | I_D MAX |
|--------------|-----------------------|-----------|
| 40 V | 12 m Ω @ 5.0 V | 69 A |
| | 7.5 m Ω @ 10 V | |



N-CHANNEL MOSFET

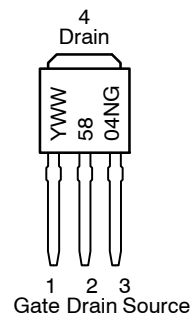
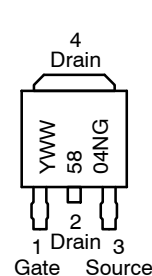


DPAK
CASE 369C
(Surface Mount)
STYLE 2



IPAK
CASE 369D
(Straight Lead
DPAK)

MARKING DIAGRAMS & PIN ASSIGNMENT



Y = Year
WW = Work Week
5804N = Device Code
G = Pb-Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

NTD5804N, NTDV5804N

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 | 40 | 45 | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V _{(BR)DSS} /T _J | | | 41 | | mV/°C |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{GS} = 0 V, V _{DS} = 40 V | T _J = 25°C | | 1.0 | μA |
| | | | T _J = 150°C | | 100 | |
| Gate-to-Source Leakage Current | I _{GSS} | V _{DS} = 0 V, V _{GS} = ±20 V | | | ±100 | nA |

ON CHARACTERISTICS (Note 2)

| | | | | | | |
|--|-------------------------------------|---|-----|-----|-----|-------|
| Gate Threshold Voltage | V _{GS(TH)} | V _{GS} = V _{DS} , I _D = 250 μA | 2.0 | | 3.5 | V |
| Negative Threshold Temperature Coefficient | V _{GS(TH)} /T _J | | | 7.3 | | mV/°C |
| Drain-to-Source On Resistance | R _{DS(on)} | V _{GS} = 10 V, I _D = 30 A | | 5.7 | 7.5 | mΩ |
| | | V _{GS} = 5 V, I _D = 10 A | | 7.9 | 12 | |
| Forward Transconductance | g _{FS} | V _{DS} = 15 V, I _D = 15 A | | 12 | | S |

CHARGES, CAPACITANCES AND GATE RESISTANCES

| | | | | | | |
|------------------------------|---------------------|--|--|------|------|----|
| Input Capacitance | C _{iss} | V _{GS} = 0 V, f = 1.0 MHz, V _{DS} = 25 V | | 2460 | 2850 | pF |
| Output Capacitance | C _{oss} | | | 310 | 400 | |
| Reverse Transfer Capacitance | C _{rss} | | | 215 | 280 | |
| Total Gate Charge | Q _{G(TOT)} | V _{GS} = 10 V, V _{DS} = 32 V, I _D = 30 A | | 45 | | nC |
| Threshold Gate Charge | Q _{G(TH)} | | | 2.8 | | |
| Gate-to-Source Charge | Q _{GS} | | | 10 | | |
| Gate-to-Drain Charge | Q _{GD} | | | 12.6 | | |

SWITCHING CHARACTERISTICS (Note 3)

| | | | | | | |
|---------------------|---------------------|--|--|------|--|----|
| Turn-On Delay Time | t _{d(on)} | V _{GS} = 10 V, V _{DD} = 32 V, I _D = 30 A, R _G = 2.5 Ω | | 11.8 | | ns |
| Rise Time | t _r | | | 18.7 | | |
| Turn-Off Delay Time | t _{d(off)} | | | 26.8 | | |
| Fall Time | t _f | | | 5.9 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-------------------------|-----------------|---|------------------------|--|------|-----|----|
| Forward Diode Voltage | V _{SD} | V _{GS} = 0 V, I _S = 10 A | T _J = 25°C | | 0.81 | 1.2 | V |
| | | | T _J = 150°C | | 0.63 | | |
| Reverse Recovery Time | t _{RR} | V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = 30 A | | | 21.7 | | ns |
| Charge Time | t _a | | | | 11.9 | | |
| Discharge Time | t _b | | | | 9.8 | | |
| Reverse Recovery Charge | Q _{RR} | | | | 11.8 | | nC |

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

3. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CHARACTERISTICS

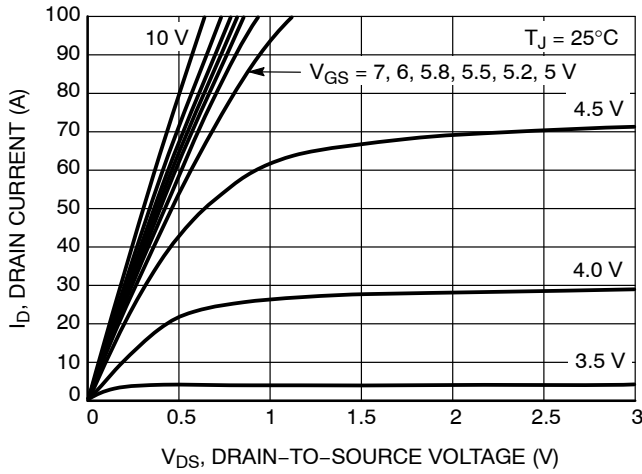


Figure 1. On-Region Characteristics

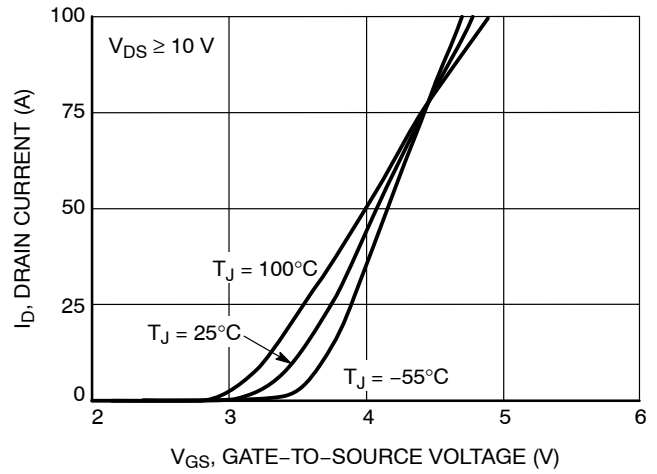


Figure 2. Transfer Characteristics

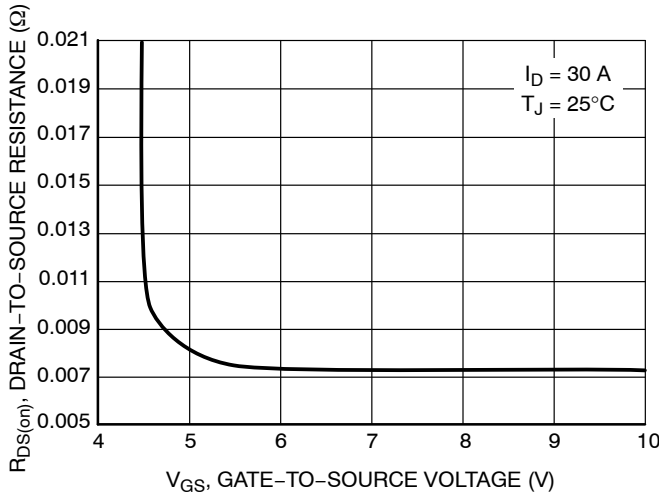


Figure 3. On-Resistance vs. Drain Current

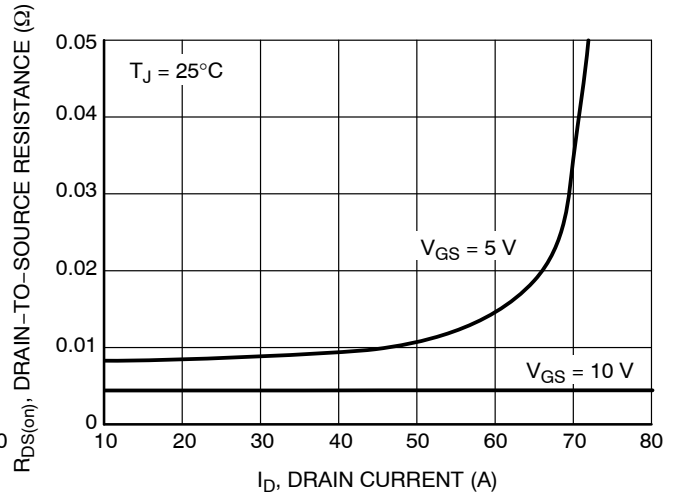


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

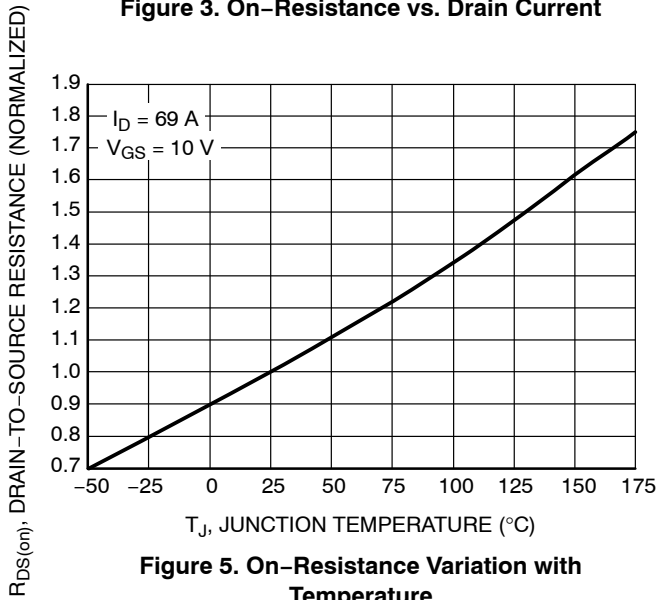


Figure 5. On-Resistance Variation with Temperature

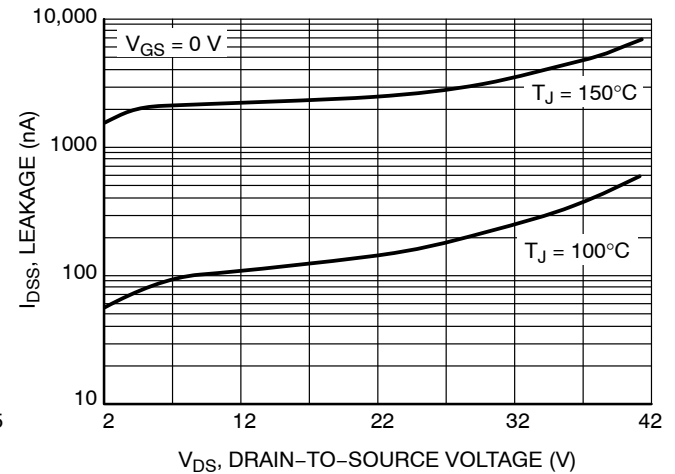


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CHARACTERISTICS

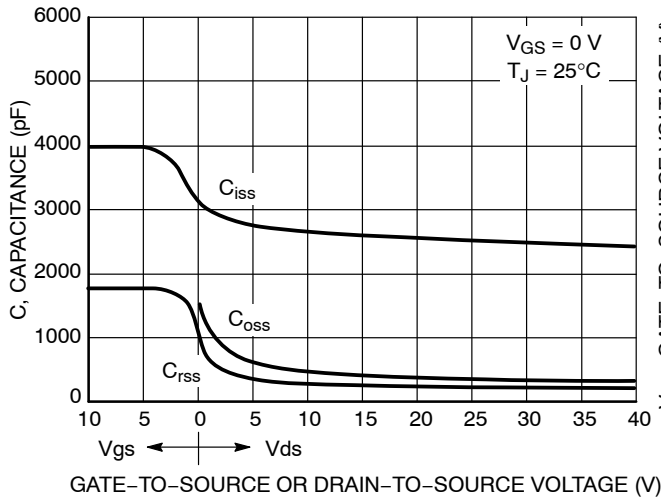


Figure 7. Capacitance Variation

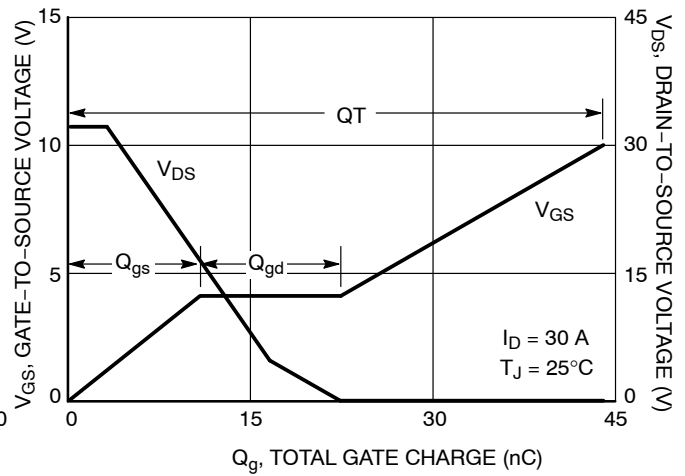


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

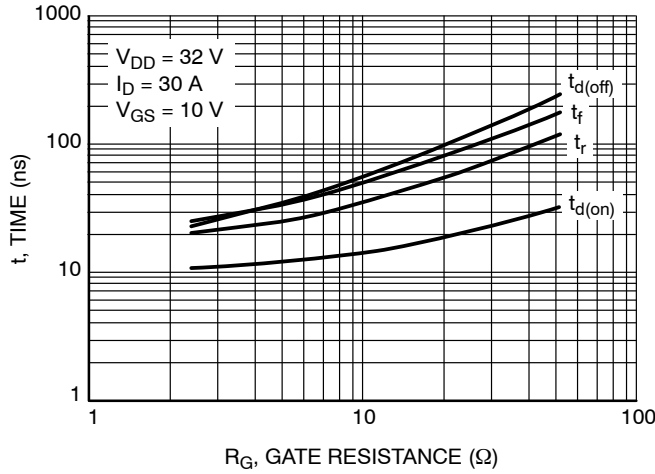


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

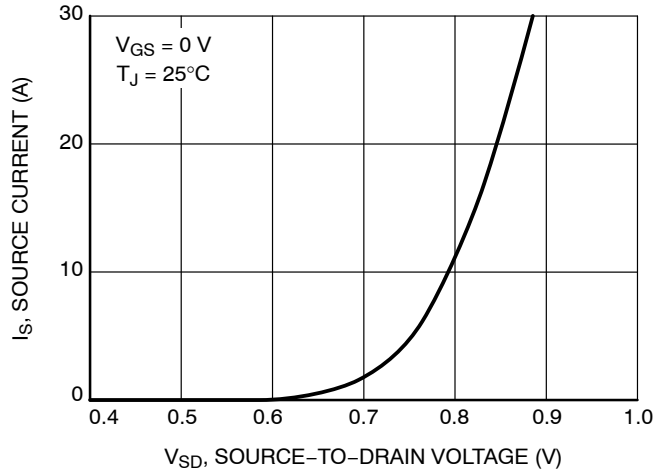


Figure 10. Diode Forward Voltage vs. Current

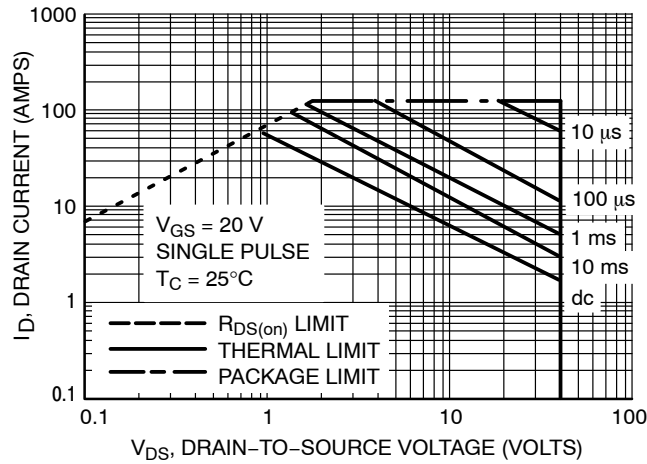


Figure 11. Maximum Rated Forward Biased Safe Operating Area

NTD5804N, NTDV5804N

TYPICAL PERFORMANCE CHARACTERISTICS

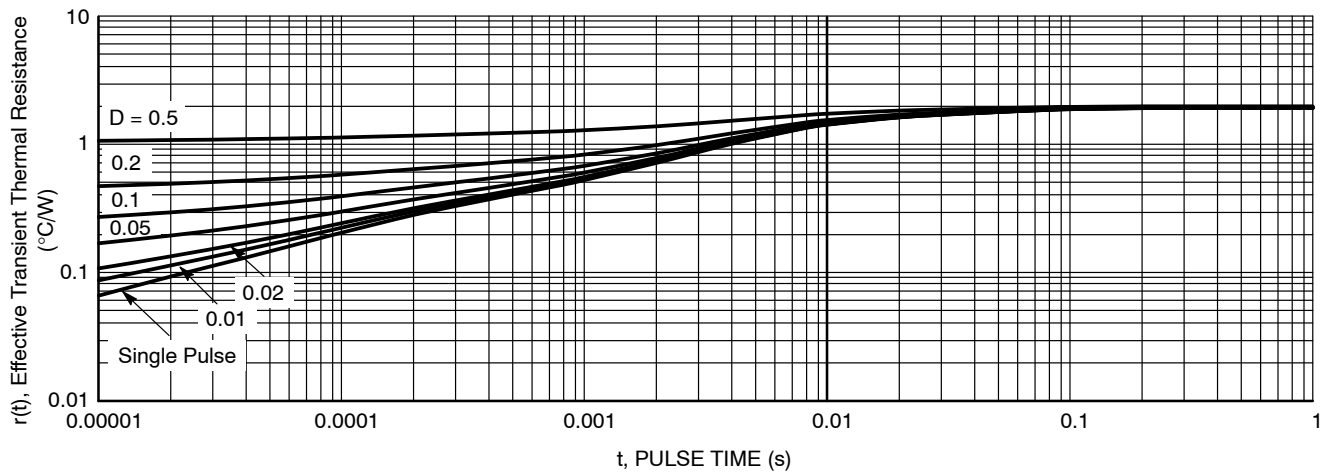


Figure 12. Thermal Response

ORDERING INFORMATION

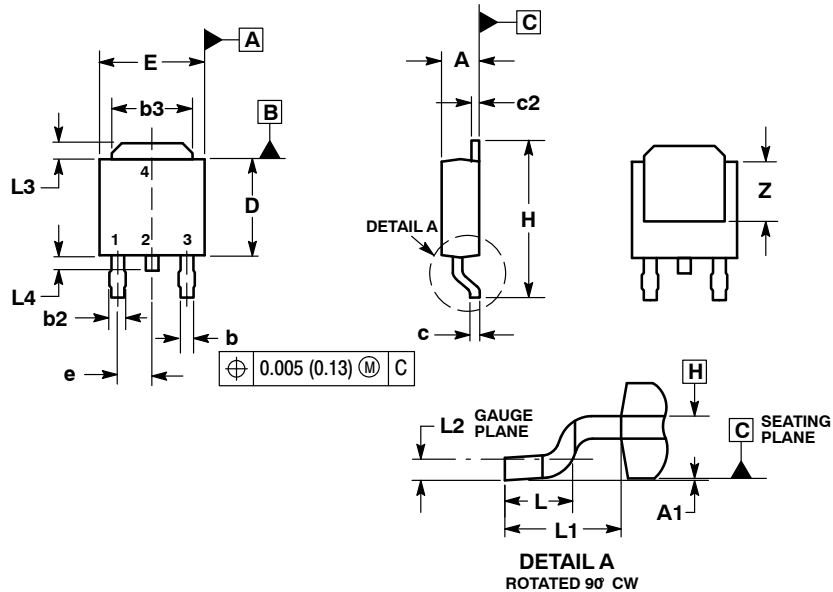
| Order Number | Package | Shipping [†] |
|--------------|--|-----------------------|
| NTD5804NG | IPAK (Straight Lead DPAK) (Pb-Free) | 75 Units / Rail |
| NTD5804NT4G | DPAK (Pb-Free) | 2500 / Tape & Reel |
| NTDV5804NT4G | DPAK (Pb-Free) | 2500 / Tape & Reel |

[†]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.

NTD5804N, NTDV5804N

PACKAGE DIMENSIONS

DPAK CASE 369C-01 ISSUE D



NOTES:

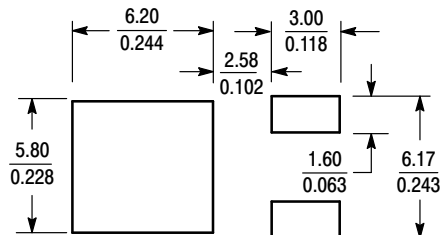
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
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 | --- |

STYLE 2:

- PIN 1. GATE
- DRAIN
- SOURCE
- DRAIN

SOLDERING FOOTPRINT*



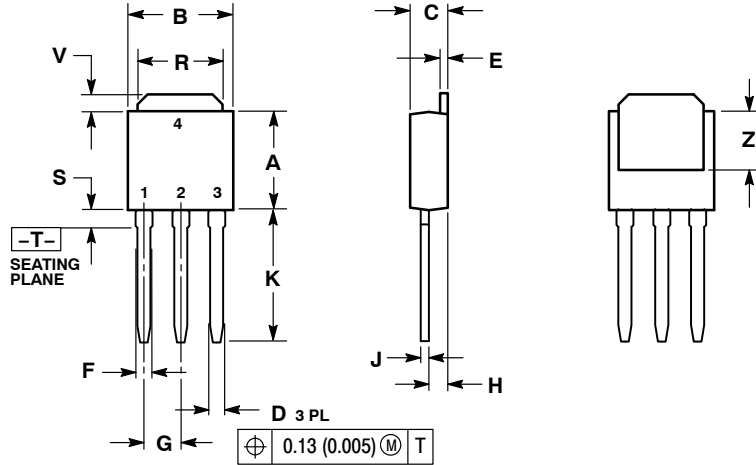
SCALE 3:1 ($\frac{\text{mm}}{\text{inches}}$)

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NTD5804N, NTDV5804N

PACKAGE DIMENSIONS

IPAK (STRAIGHT LEAD DPAK) CASE 369D-01 ISSUE C




- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. 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

ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marketing.pdf. SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative