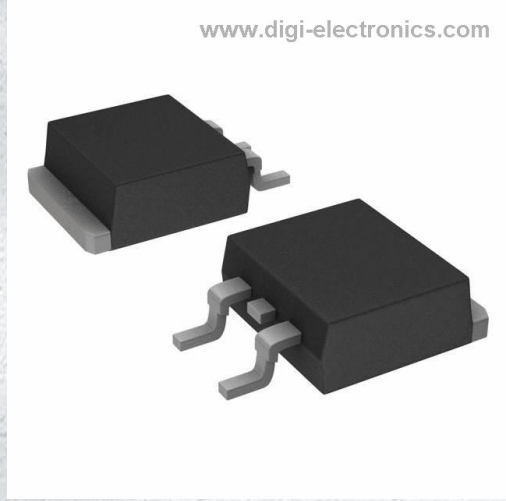
# NTD95N02RG Datasheet




| | |
|---|---|
| DiGi Electronics Part Number | NTD95N02RG-DG |
| Manufacturer | onsemi |
| Manufacturer Product Number | NTD95N02RG |
| Description | MOSFET N-CH 24V 12A/32A DPAK |
| Detailed Description | N-Channel 24 V 12A (Ta), 32A (Tc) 1.25W (Ta), 86W (Tc) Surface Mount DPAK |

https://www.DiGi-Electronics.com

Tel: +00 852-30501935

RFQ Email: Info@DiGi-Electronics.com

## Purchase and inquiry

| Manufacturer Product Number: | Manufacturer: |
| --- | --- |
| NTD95N02RG | onsemi |
| Series: | Product Status: |
| - | Obsolete |
| FET Type: | Technology: |
| N-Channel | MOSFET (Metal Oxide) |
| Drain to Source Voltage (Vdss): | Current - Continuous Drain (Id) @ 25°C: |
| 24 V | 12A (Ta), 32A (Tc) |
| Drive Voltage (Max Rds On, Min Rds On): | Rds On (Max) @ Id, Vgs: |
| 4.5V, 10V | 5mOhm @ 20A, 10V |
| Vgs(th) (Max) @ Id: | Gate Charge (Qg) (Max) @ Vgs: |
| 2V @ 250µA | 21 nC @ 4.5 V |
| Vgs (Max): | Input Capacitance (Ciss) (Max) @ Vds: |
| ±20V | 2400 pF @ 20 V |
| FET Feature: | Power Dissipation (Max): |
| - | 1.25W (Ta), 86W (Tc) |
| Operating Temperature: | Mounting Type: |
| -55°C ~ 150°C (TJ) | Surface Mount |
| Supplier Device Package: | Package / Case: |
| DPAK | TO-252-3, DPAK (2 Leads + Tab), SC-63 |
| Base Product Number: | |
| NTD95 | |

## Environmental & Export classification

| Moisture Sensitivity Level (MSL): | REACH Status: |
| --- | --- |
| 1 (Unlimited) | REACH Unaffected |
| ECCN: | HTSUS: |
| EAR99 | 8541.29.0095 |

# ON Semiconductor

# Is Now

**To learn more about onsemi™, please visit our website at**
**www.onsemi.com**

# NTD95N02R

# Power MOSFET 95 Amps, 24 Volts

## N−Channel DPAK

### Features

- High Power and Current Handling Capability
- Fast Switching Performance
- Low $R_{DS(on)}$ to Minimize Conduction Loss
- Low Gate Charge to Minimize Switching Losses
- Pb−Free Packages are Available

### Applications

- CPU Motherboard Vcore Applications
- High Frequency DC−DC Converters
- Motor Drives
- Bridge Circuits

**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise specified)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain−to−Source Voltage | $V_{DSS}$ | 24 | V |
| Gate−to−Source Voltage | $V_{GS}$ | ±20 | V |
| Thermal Resistance, Junction−to−Case<br>Total Power Dissipation @ $T_A$ = 25°C<br>Drain Current – | $R_{\theta JC}$<br>$P_D$ | 1.45<br>86 | °C/W<br>W |
| − Continuous @ $T_A$= 25°C, Limited by Package<br>− Continuous @ $T_A$= 25°C, Limited by Wires | $I_D$<br>$I_D$ | 95<br>32 | A<br>A |
| Thermal Resistance, Junction−to− Ambient (Note 1)<br>− Total Power Dissipation @ $T_A$ = 25°C<br>− Drain Current − Continuous @ $T_A$= 25°C | $R_{\theta JA}$<br>$P_D$<br>$I_D$ | 52<br>2.4<br>15.8 | °C/W<br>W<br>A |
| Thermal Resistance, Junction−to−Ambient (Note 2)<br>− Total Power Dissipation @ $T_A$ = 25°C<br>− Drain Current − Continuous @ $T_A$= 25°C | $R_{\theta JA}$<br>$P_D$<br>$I_D$ | 100<br>1.25<br>12 | °C/W<br>W<br>A |
| Operating Junction and Storage Temperature | $T_J$, $T_{STG}$ | −55 to 150 | °C |
| Continuous Source Current (Body Diode) | $I_S$ | 45 | A |
| Single Pulse Drain−to−Source Avalanche Energy – ($V_{DD}$ = 25 V, $V_G$ = 10, $I_{PK}$ = 13 A, L = 1 mH, $R_G$= 25 Ω) | $E_{AS}$ | 84 | mJ |
| Lead Temperature for Soldering Purposes (1/8 in from case for 10 seconds) | $T_L$ | 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.

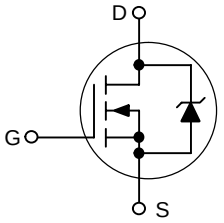
1. Surface mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
2. Surface mounted on FR4 board using the minimum recommended pad size (Cu area = 0.412 in sq).

**ON Semiconductor®**

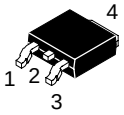
**http://onsemi.com**

| $V_{(BR)DSS}$ | $R_{DS(ON)}$ TYP | $I_D$ MAX* |
|---|---|---|
| 24 V | 4.5 mΩ @ 10 V | 95 A |
| | 5.9 mΩ @ 4.5 V | |

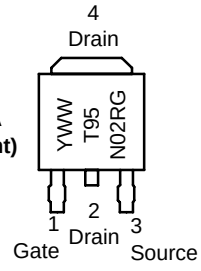
*$I_D$ MAX in the product summary table is continuous and steady at 25°C.

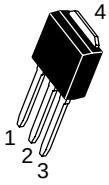



**MARKING DIAGRAMS & PIN ASSIGNMENTS**

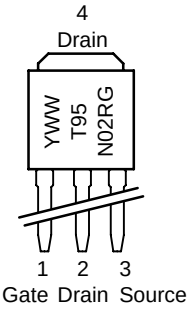



**DPAK**
**CASE 369AA**
**(Surface Mount)**
**STYLE 2**




**DPAK**
**CASE 369D**
**(Straight Lead)**
**STYLE 2**




| | |
|---|---|
| Y | = Year |
| WW | = Work Week |
| T95N02R | = Device Code |
| G | = Pb−Free Package |

**ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.



July, 2006 − Rev. 3

Publication Order Number:
NTD95N02R/D

## THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction−to−Case (Drain) | $R_{\theta JC}$ | 1.45 | °C/W |
| Junction−to−Ambient – Steady State (Note 3) | $R_{\theta JA}$ | 52 | |
| Junction−to−Ambient – Steady State (Note 4) | $R_{\theta JA}$ | 100 | |

3. Surface mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
4. Surface mounted on FR4 board using the minimum recommended pad size (Cu area = 0.412 in sq).

## 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 | | 24 | 29 | | V |
| Drain−to−Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | | 15 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 20 V | $T_J$ = 25°C | | | 1.5 | μA |
| | | | $T_J$ = 125°C | | | 10 | |
| Gate−to−Source Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±20 V | | | | ±100 | nA |
| **ON CHARACTERISTICS** (Note 5) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | | 1.0 | | 2.0 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | | 5.0 | | mV/°C |
| Drain−to−Source On−Resistance | $R_{DS(on)}$ | $V_{GS}$ = 4.5 V, $I_D$ = 10 A | | | 5.9 | 8.0 | mΩ |
| | | $V_{GS}$ = 10 V, $I_D$ = 20 A | | | 4.5 | 5.0 | |
| Forward Transconductance | gFS | $V_{GS}$ = 10 V, $I_D$ = 10 A | | | 30 | | S |
| **CHARGES, CAPACITANCES AND GATE RESISTANCE** | | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 1.0 MHz, $V_{DS}$ = 20 V | | | 2400 | | pF |
| Output Capacitance | $C_{OSS}$ | | | | 1020 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | | 390 | | |
| Total Gate Charge | $Q_T$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 10 V; $I_D$ = 10 A | | | 21 | | nC |
| | $Q_{GS}$ | | | | 4.4 | | |
| | $Q_{GD}$ | | | | 9.1 | | |
| **SWITCHING CHARACTERISTICS** | | | | | | | |
| Turn−on Delay Time | $t_{d(on)}$ | $V_{GS}$ = 10 V, $V_{DD}$ = 10 V, $I_D$ = 30 A, $R_G$ = 3 Ω | | | 10 | | ns |
| Rise Time | $t_r$ | | | | 82 | | |
| Turn−off Time | $t_{d(off)}$ | | | | 26 | | |
| Fall Time | $t_f$ | | | | 70 | | |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = 20 A | $T_J$ = 25°C | | 0.83 | 1.2 | V |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, $d_{ISD}/dt$ = 100 A/μs, $I_S$ = 20 A | | | 45 | | ns |
| Charge Time | $T_a$ | | | | 20 | | |
| Discharge Time | $T_b$ | | | | 30 | | |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 50 | | nC |

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

# NTD95N02R

## TYPICAL CHARACTERISTICS

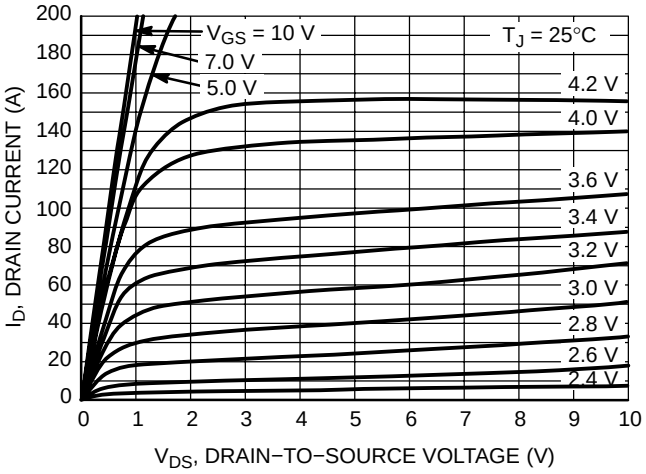



**Figure 1. On−Region Characteristics**

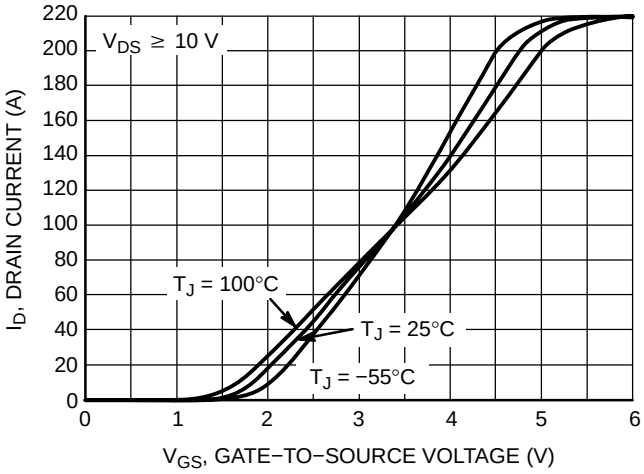



**Figure 2. Transfer Characteristics**

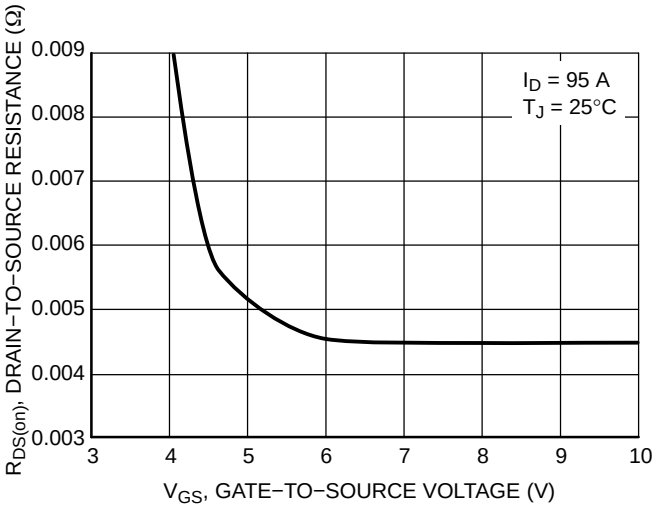



**Figure 3. On−Resistance versus Gate−to−Source Voltage**

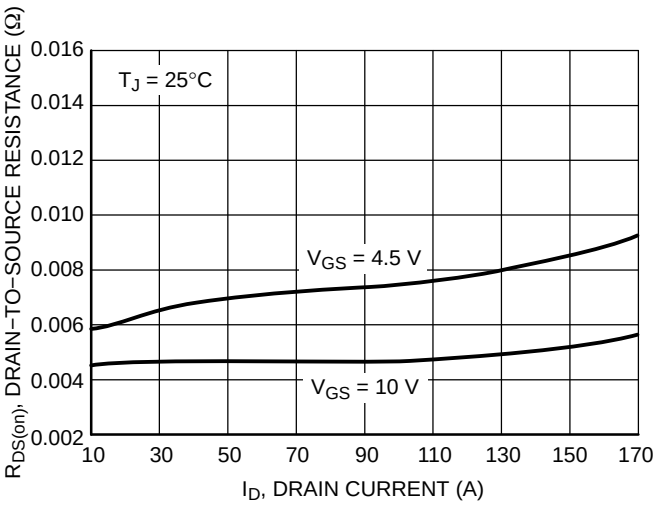



**Figure 4. On−Resistance versus Drain Current and Gate Voltage**

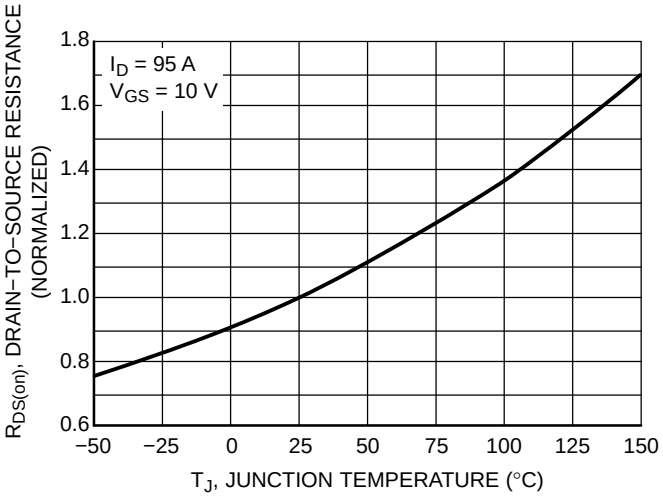



**Figure 5. On−Resistance Variation with Temperature**

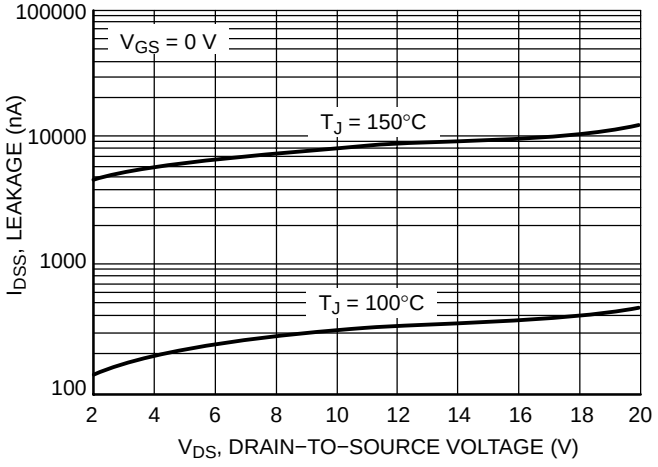



**Figure 6. Drain−to−Source Leakage Current versus Voltage**

# NTD95N02R

## TYPICAL CHARACTERISTICS

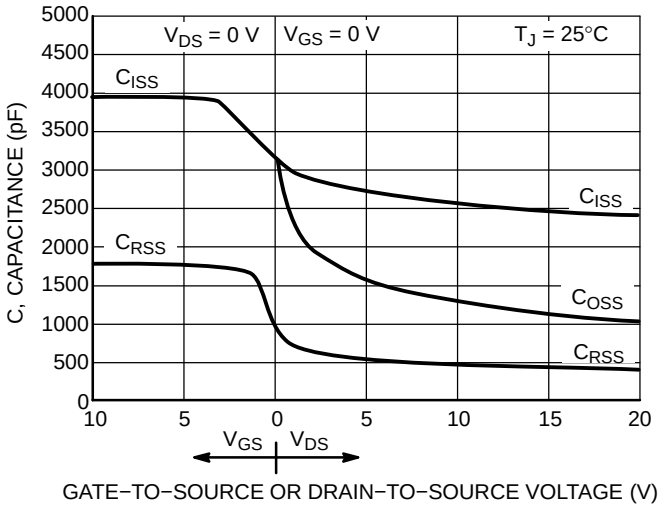



**Figure 7. Capacitance Variation**

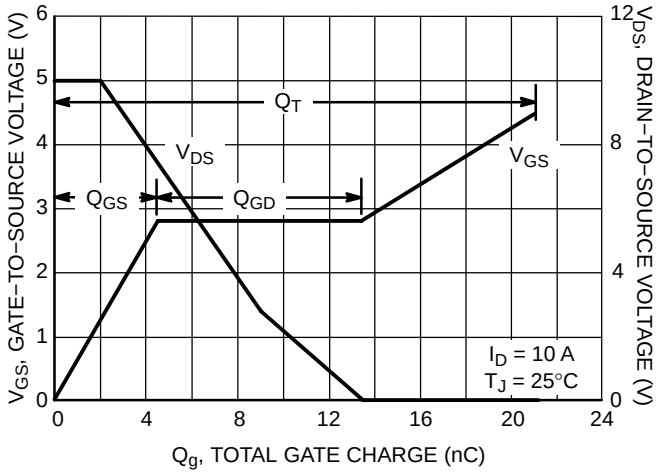



**Figure 8. Gate−to−Source and Drain−to−Source Voltage versus Total Charge**

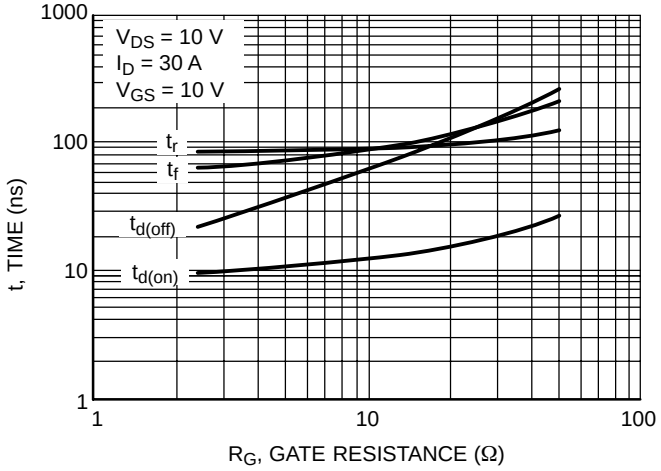



**Figure 9. Resistive Switching Time Variation versus Gate Resistance**

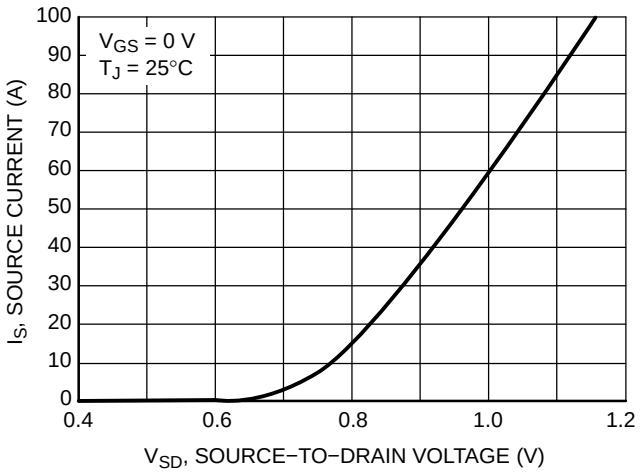



**Figure 10. Diode Forward Voltage versus Current**

**ORDERING INFORMATION**

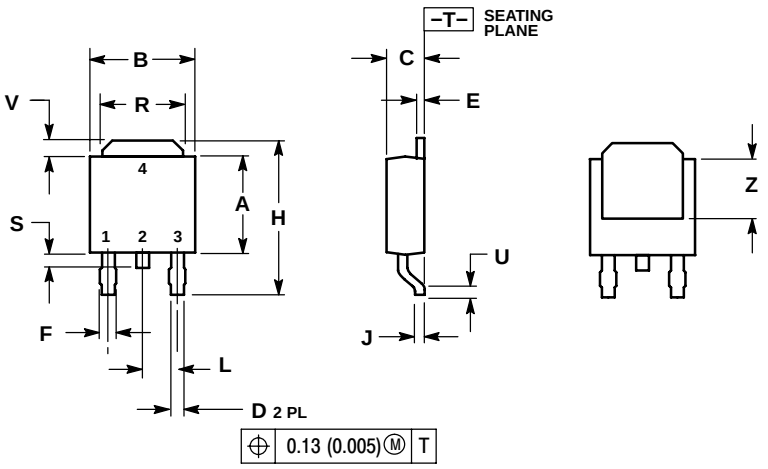
| Device | Package | Shipping† |
|---|---|---|
| NTD95N02R | DPAK | 75 Units / Rail |
| NTD95N02RG | DPAK (Pb−Free) | 75 Units / Rail |
| NTD95N02R−001 | DPAK | 75 Units / Rail |
| NTD95N02R−001G | DPAK (Pb−Free) | 75 Units / Rail |
| NTD95N02RT4 | DPAK | 2500 Units / Tape & Reel |
| NTD95N02RT4G | DPAK (Pb−Free) | 2500 Units / 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.

# NTD95N02R

## PACKAGE DIMENSIONS

**DPAK (SINGLE GUAGE)**
CASE 369AA−01
ISSUE A

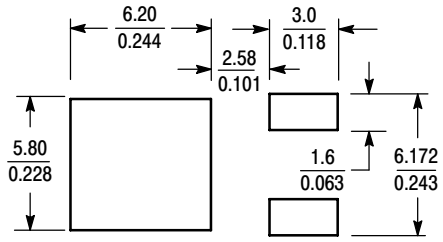



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.235 | 0.245 | 5.97 | 6.22 |
| B | 0.250 | 0.265 | 6.35 | 6.73 |
| C | 0.086 | 0.094 | 2.19 | 2.38 |
| D | 0.025 | 0.035 | 0.63 | 0.89 |
| E | 0.018 | 0.024 | 0.46 | 0.61 |
| F | 0.030 | 0.045 | 0.77 | 1.14 |
| H | 0.386 | 0.410 | 9.80 | 10.40 |
| J | 0.018 | 0.023 | 0.46 | 0.58 |
| L | 0.090 BSC | | 2.29 BSC | |
| R | 0.180 | 0.215 | 4.57 | 5.45 |
| S | 0.024 | 0.040 | 0.60 | 1.01 |
| U | 0.020 | −−− | 0.51 | −−− |
| 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

### SOLDERING FOOTPRINT*



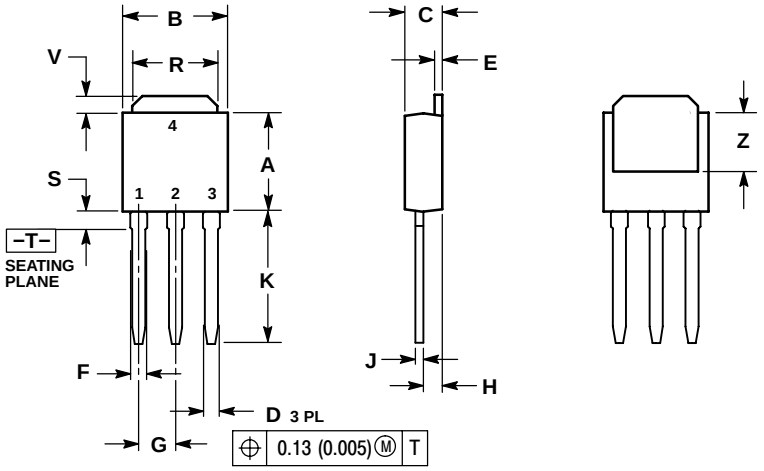

SCALE 3:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

# NTD95N02R

## PACKAGE DIMENSIONS

**DPAK**
CASE 369D−01
ISSUE B




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

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | 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



**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: 81−3−5773−3850

**ON Semiconductor Website**: **www.onsemi.com**

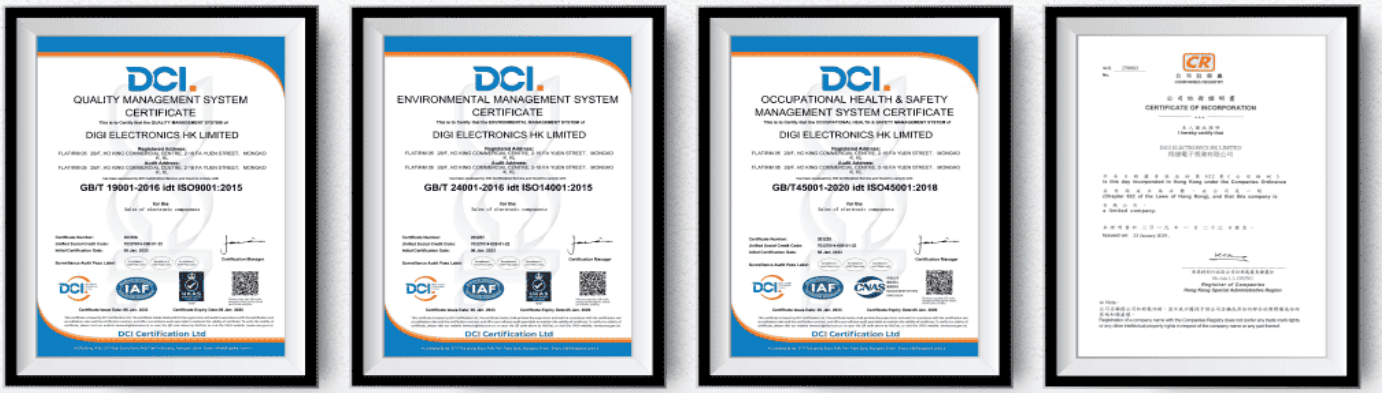
**Order Literature**: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

**NTD95N02R/D**

# OUR CERTIFICATE

DiGi provide top-quality products and perfect service for customer worldwide through standardization, technological innovation and continuous improvement.  DiGi through third-party certification, we striciy control the quality of products and services. Welcome your RFQ to Email: Info@DiGi-Electronics.com





Tel: +00 852-30501935

RFQ Email: Info@DiGi-Electronics.com

DiGi is a global authorized distributor of electronic components.