

NTD4904N

MOSFET – Power, Single, N-Channel, DPAK/IPAK 30 V, 79 A

Features

- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- These are Pb-Free Devices

Applications

- CPU Power Delivery
- DC-DC Converters

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

| Parameter | Symbol | Value | Unit | | |
|---|-----------------------|---------------------------|---------------|------------------|---|
| Drain-to-Source Voltage | V_{DSS} | 30 | V | | |
| Gate-to-Source Voltage | V_{GS} | ± 20 | V | | |
| Continuous Drain Current ($R_{\theta JA}$) (Note 1) | I_D | $T_A = 25^\circ\text{C}$ | 17.8 | A | |
| | | $T_A = 100^\circ\text{C}$ | 12.6 | | |
| Power Dissipation ($R_{\theta JA}$) (Note 1) | P_D | $T_A = 25^\circ\text{C}$ | 2.6 | W | |
| | | $T_A = 100^\circ\text{C}$ | 9.2 | | |
| Continuous Drain Current ($R_{\theta JC}$) (Note 2) | I_D | $T_A = 25^\circ\text{C}$ | 13 | A | |
| | | $T_A = 100^\circ\text{C}$ | 9.2 | | |
| Power Dissipation ($R_{\theta JC}$) (Note 2) | P_D | $T_A = 25^\circ\text{C}$ | 1.4 | W | |
| | | $T_C = 25^\circ\text{C}$ | 52 | | |
| Continuous Drain Current ($R_{\theta JC}$) (Note 1) | I_D | $T_C = 25^\circ\text{C}$ | 79 | A | |
| | | $T_C = 100^\circ\text{C}$ | 56 | | |
| Power Dissipation ($R_{\theta JC}$) (Note 1) | P_D | $T_C = 25^\circ\text{C}$ | 52 | W | |
| | | $T_C = 100^\circ\text{C}$ | 9.2 | | |
| Pulsed Drain Current | $t_p = 10\mu\text{s}$ | $T_A = 25^\circ\text{C}$ | I_{DM} | 316 | A |
| Current Limited by Package | | $T_A = 25^\circ\text{C}$ | $I_{DmaxPkg}$ | 90 | A |
| Operating Junction and Storage Temperature | T_J, T_{stg} | -55 to 175 | | $^\circ\text{C}$ | |
| Source Current (Body Diode) | I_S | 47 | | A | |
| Drain to Source dV/dt | dV/dt | 6.0 | | V/ns | |
| Single Pulse Drain-to-Source Avalanche Energy ($T_J = 25^\circ\text{C}$, $V_{DD} = 50\text{ V}$, $V_{GS} = 10\text{ V}$, $L = 0.1\text{ mH}$, $I_{L(pk)} = 37\text{ A}$, $R_G = 25\ \Omega$) | E_{AS} | 68.4 | | mJ | |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | T_L | 260 | | $^\circ\text{C}$ | |

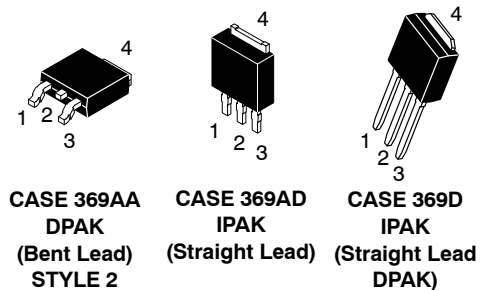
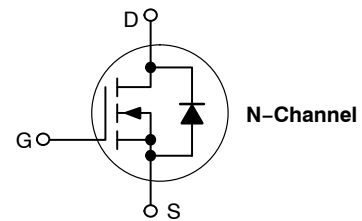
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



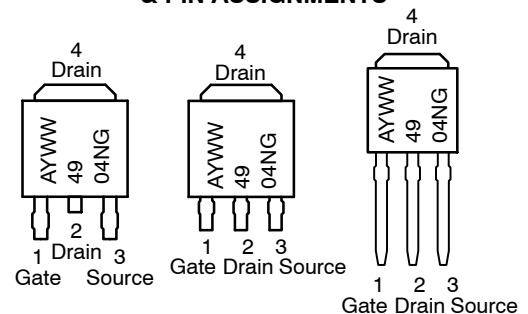
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<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | I_D MAX |
|---------------|------------------------|-----------|
| 30 V | 3.7 m Ω @ 10 V | 79 A |
| | 5.5 m Ω @ 4.5 V | |



MARKING DIAGRAMS & PIN ASSIGNMENTS



A = Assembly Location
 Y = Year
 WW = Work Week
 4904N = Device Code
 G = Pb-Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

NTD4904N

THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter | Symbol | Value | Unit |
|---|---------------------|-------|------|
| Junction-to-Case (Drain) | $R_{\theta JC}$ | 2.9 | °C/W |
| Junction-to-Tab (Drain) | $R_{\theta JC-TAB}$ | 4.3 | |
| Junction-to-Ambient - Steady State (Note 1) | $R_{\theta JA}$ | 57 | |
| Junction-to-Ambient - Steady State (Note 2) | $R_{\theta JA}$ | 108 | |

- Surface-mounted on FR4 board using 1 in sq pad size, 1 oz Cu.
- Surface-mounted on FR4 board using the minimum recommended pad size.

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

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

OFF CHARACTERISTICS

| | | | | | | |
|---|-------------------|---|---------------------------|----|-----------|---------------|
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$ | 30 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | 15 | | mV/°C |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$ | $T_J = 25^\circ\text{C}$ | | 1.0 | μA |
| | | | $T_J = 125^\circ\text{C}$ | | 10 | |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ | | | ± 100 | nA |

ON CHARACTERISTICS (Note 3)

| | | | | | | | |
|--|------------------|--|---------------------|-----|-----|-------|------------|
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$ | 1.0 | 1.6 | 2.2 | V | |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | 4.0 | | mV/°C | |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}$ | $I_D = 30\text{ A}$ | | 3.0 | 3.7 | m Ω |
| | | | $I_D = 15\text{ A}$ | | 3.0 | | |
| | | $V_{GS} = 4.5\text{ V}$ | $I_D = 30\text{ A}$ | | 4.0 | 5.5 | |
| | | | $I_D = 15\text{ A}$ | | 4.0 | | |
| Forward Transconductance | g_{FS} | $V_{DS} = 1.5\text{ V}, I_D = 30\text{ A}$ | | 76 | | S | |

CHARGES AND CAPACITANCES

| | | | | | | |
|------------------------------|--------------|--|--|------|--|----|
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 15\text{ V}$ | | 3052 | | pF |
| Output Capacitance | C_{oss} | | | 976 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 23 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 30\text{ A}$ | | 16.8 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 4.4 | | |
| Gate-to-Source Charge | Q_{GS} | | | 8.2 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 3.0 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}, I_D = 30\text{ A}$ | | 41 | | nC |

SWITCHING CHARACTERISTICS (Note 4)

| | | | | | | |
|---------------------|--------------|---|--|------|--|----|
| Turn-On Delay Time | $t_{d(on)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\ \Omega$ | | 15.3 | | ns |
| Rise Time | t_r | | | 19.8 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 23.4 | | |
| Fall Time | t_f | | | 7.5 | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\ \Omega$ | | 10.3 | | ns |
| Rise Time | t_r | | | 20 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 28.7 | | |
| Fall Time | t_f | | | 8.0 | | |

- Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.
- Switching characteristics are independent of operating junction temperatures.

NTD4904N

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

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

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | |
|-----------------------|----------|---|---------------------------|------|-----|----|
| Forward Diode Voltage | V_{SD} | $V_{GS} = 0\text{ V},$ $I_S = 30\text{ A}$ | $T_J = 25^\circ\text{C}$ | 0.84 | 1.1 | V |
| | | | $T_J = 125^\circ\text{C}$ | 0.7 | | |
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0\text{ V},$ dls/dt= 100 A/ $\mu\text{s},$ $I_S = 30\text{ A}$ | | 40.4 | | ns |
| Charge Time | t_a | | | 20.5 | | |
| Discharge Time | t_b | | | 19.9 | | |
| Reverse Recovery Time | Q_{RR} | | | 35 | | |

PACKAGE PARASITIC VALUES

| | | | | | | |
|---------------------------------|-------|--------------------------|--|--------|-----|----|
| Source Inductance (Note 5) | L_S | $T_A = 25^\circ\text{C}$ | | 2.48 | | nH |
| Drain Inductance, DPAK | L_D | | | 0.0164 | | |
| Drain Inductance, IPAK (Note 5) | L_D | | | 1.88 | | |
| Gate Inductance (Note 5) | L_G | | | 4.9 | | |
| Gate Resistance | R_G | | | 1.0 | 2.0 | |

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.

5. Assume terminal length of 110 mils.

NTD4904N

TYPICAL PERFORMANCE CURVES

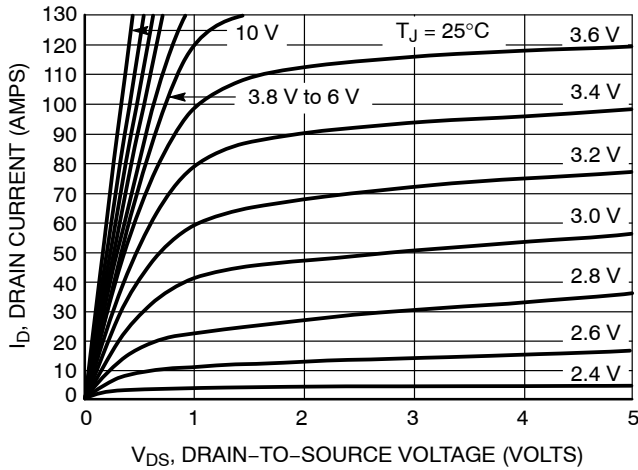


Figure 1. On-Region Characteristics

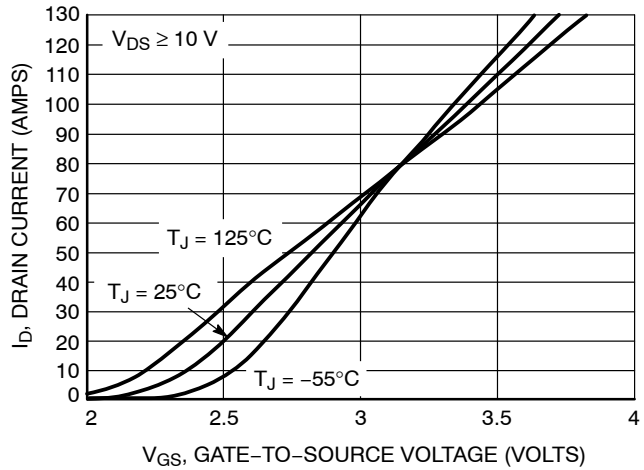


Figure 2. Transfer Characteristics

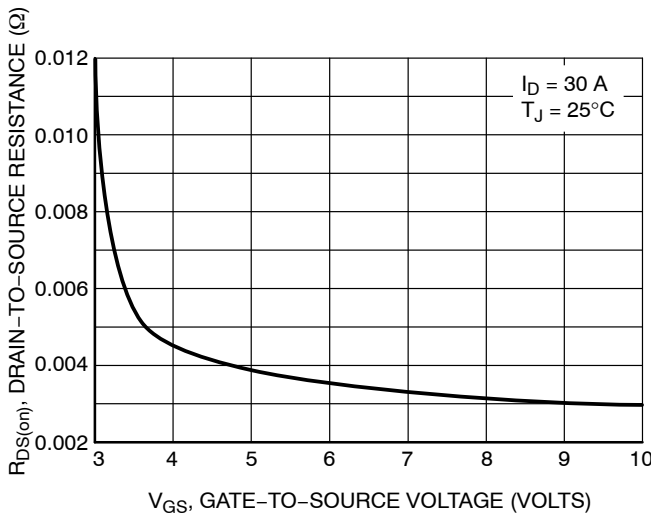


Figure 3. On-Resistance vs. Gate-to-Source Voltage

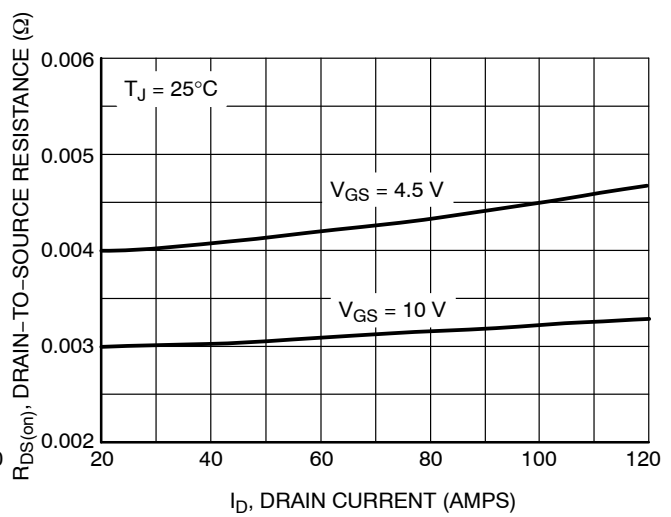


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

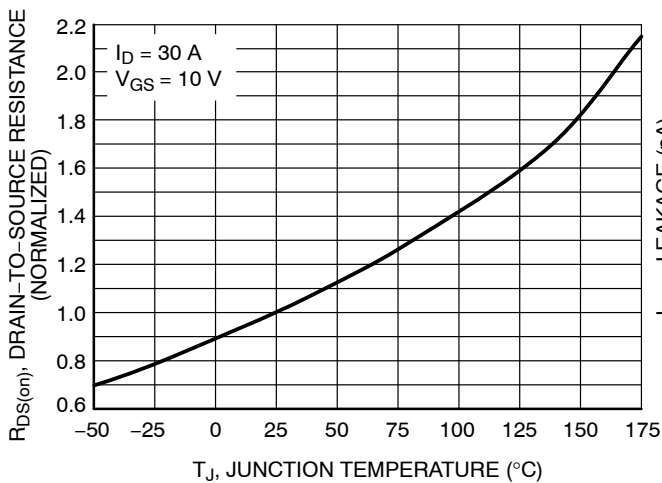


Figure 5. On-Resistance Variation with Temperature

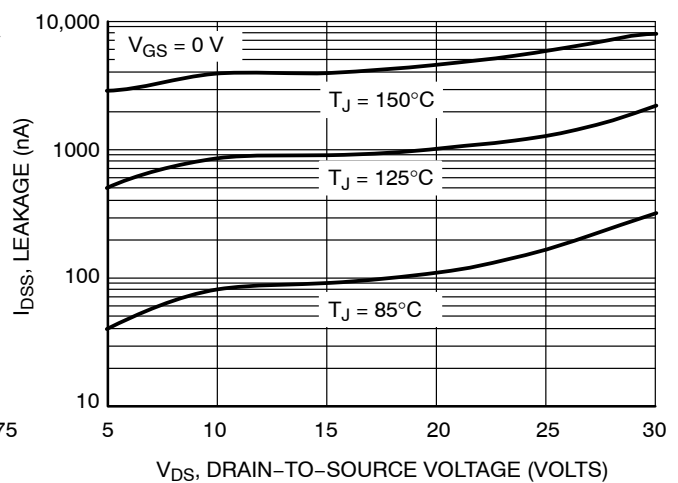


Figure 6. Drain-to-Source Leakage Current vs. Drain Voltage

TYPICAL PERFORMANCE CURVES

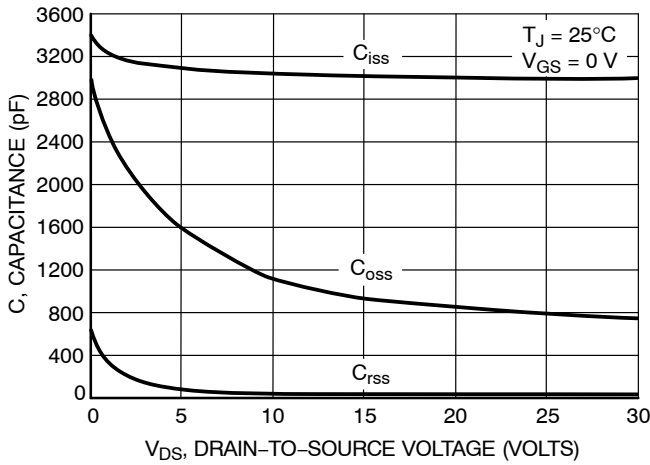


Figure 7. Capacitance Variation

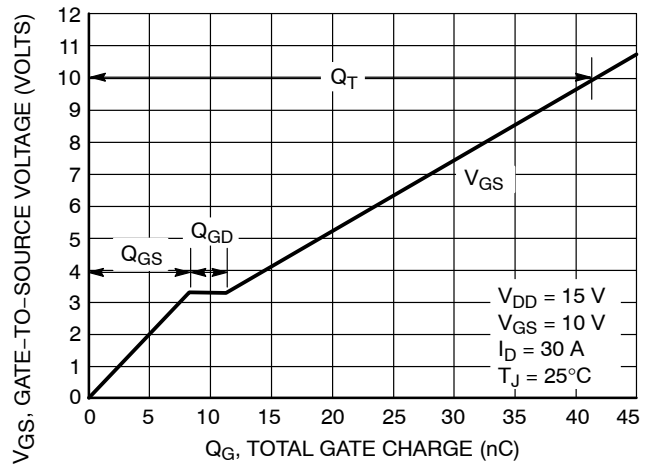


Figure 8. Gate-To-Source and Drain-To-Source Voltage vs. Total Charge

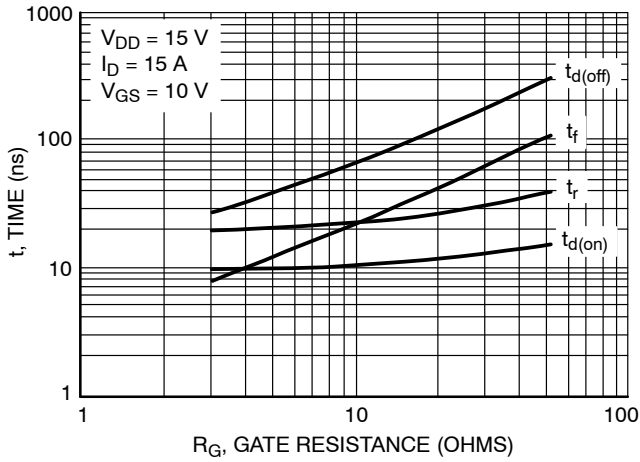


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

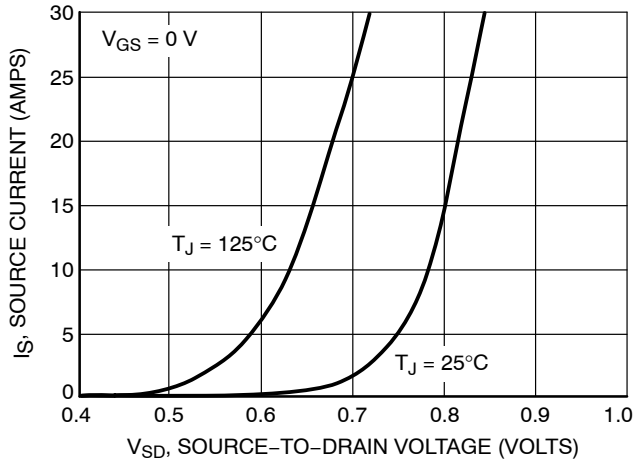


Figure 10. Diode Forward Voltage vs. Current

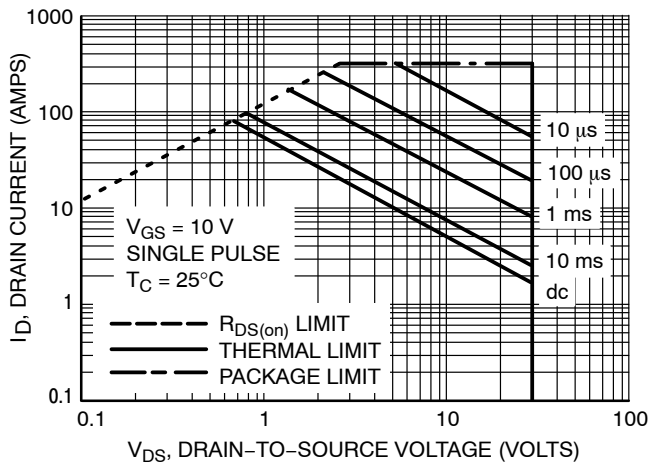


Figure 11. Maximum Rated Forward Biased Safe Operating Area

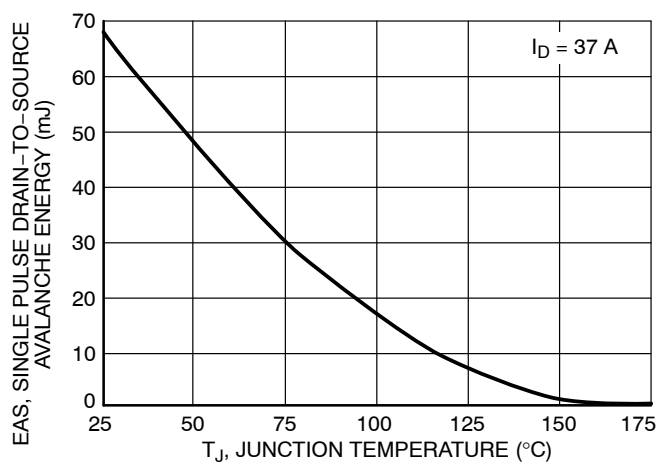


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

NTD4904N

TYPICAL PERFORMANCE CURVES

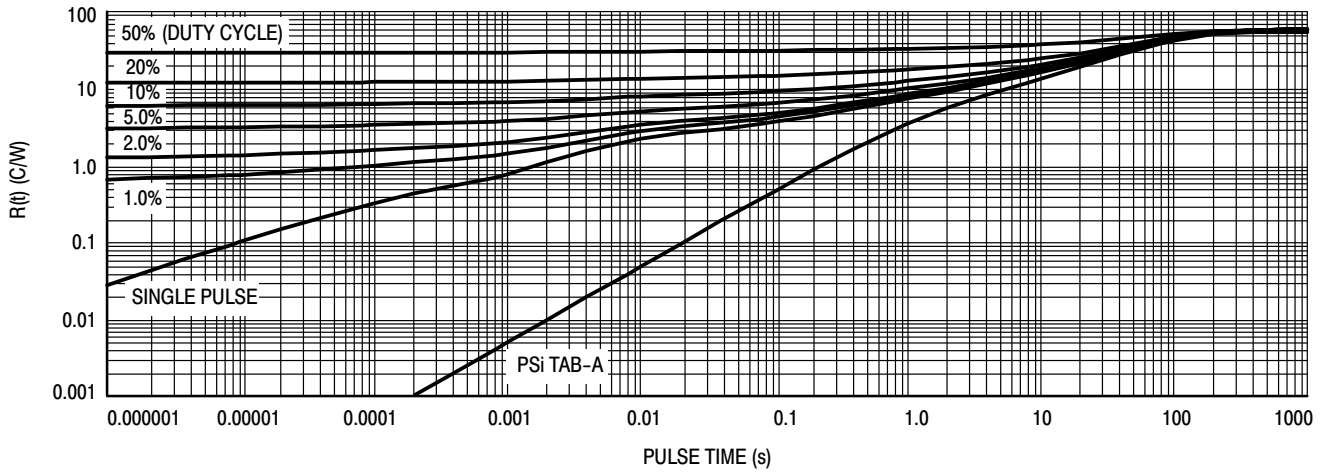


Figure 13. FET Thermal Response

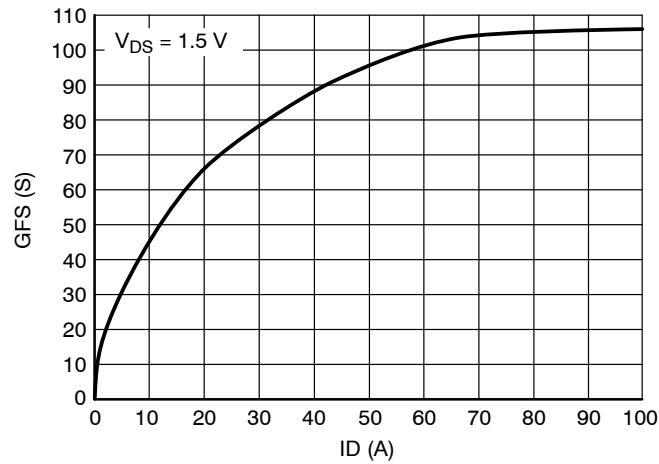


Figure 14. GFS vs I_D

ORDERING INFORMATION

| Order Number | Package | Shipping [†] |
|--------------|--------------------------------|-----------------------|
| NTD4904NT4G | DPAK (Pb-Free) | 2500 / Tape & Reel |
| NTD4904N-1G | IPAK (Pb-Free) | 75 Units / Rail |
| NTD4904N-35G | IPAK Trimmed Lead (Pb-Free) | 75 Units / Rail |

[†]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.

MECHANICAL CASE OUTLINE

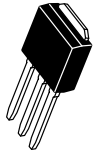
PACKAGE DIMENSIONS

ON Semiconductor®



IPAK CASE 369D-01 ISSUE C

DATE 15 DEC 2010



SCALE 1:1



- 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 | --- |

- | | | | |
|--|---|--|--|
| <p>STYLE 1: PIN 1. BASE 2. COLLECTOR 3. EMITTER 4. COLLECTOR</p> | <p>STYLE 2: PIN 1. GATE 2. DRAIN 3. SOURCE 4. DRAIN</p> | <p>STYLE 3: PIN 1. ANODE 2. CATHODE 3. ANODE 4. CATHODE</p> | <p>STYLE 4: PIN 1. CATHODE 2. ANODE 3. GATE 4. ANODE</p> |
| <p>STYLE 5: PIN 1. GATE 2. ANODE 3. CATHODE 4. ANODE</p> | <p>STYLE 6: PIN 1. MT1 2. MT2 3. GATE 4. MT2</p> | <p>STYLE 7: PIN 1. GATE 2. COLLECTOR 3. EMITTER 4. COLLECTOR</p> | |

MARKING DIAGRAMS



- xxxxxxxx = Device Code
A = Assembly Location
IL = Wafer Lot
Y = Year
WW = Work Week

| | | |
|-------------------------|------------------------------------|--|
| DOCUMENT NUMBER: | 98AON10528D | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION: | IPAK (DPAK INSERTION MOUNT) | PAGE 1 OF 1 |

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MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®



SCALE 1:1

DPAK (SINGLE GAUGE)

CASE 369AA-01

ISSUE B

DATE 03 JUN 2010



NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
- CONTROLLING DIMENSION: INCHES.
- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
- 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.
- DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
- 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 | --- |

- | | | | |
|--|---|--|--|
| <p>STYLE 1: PIN 1. BASE 2. COLLECTOR 3. EMITTER 4. COLLECTOR</p> | <p>STYLE 2: PIN 1. GATE 2. DRAIN 3. SOURCE 4. DRAIN</p> | <p>STYLE 3: PIN 1. ANODE 2. CATHODE 3. ANODE 4. CATHODE</p> | <p>STYLE 4: PIN 1. CATHODE 2. ANODE 3. GATE 4. ANODE</p> |
| <p>STYLE 5: PIN 1. GATE 2. ANODE 3. CATHODE 4. ANODE</p> | <p>STYLE 6: PIN 1. MT1 2. MT2 3. GATE 4. MT2</p> | <p>STYLE 7: PIN 1. GATE 2. COLLECTOR 3. EMITTER 4. COLLECTOR</p> | |

GENERIC MARKING DIAGRAM*



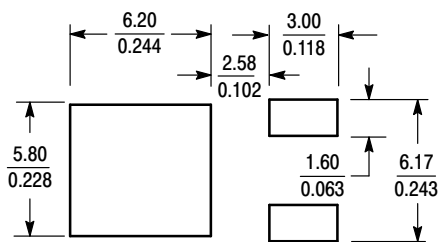
IC

Discrete

- XXXXXX = Device Code
- A = Assembly Location
- L = Wafer Lot
- Y = Year
- WW = Work Week
- G = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking.

SOLDERING FOOTPRINT*



SCALE 3:1 (mm/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.

| | | |
|-------------------------|----------------------------|--|
| DOCUMENT NUMBER: | 98AON13126D | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION: | DPAK (SINGLE GAUGE) | PAGE 1 OF 1 |

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MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®



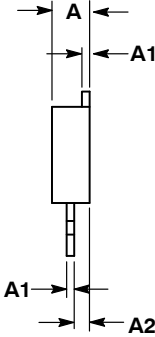
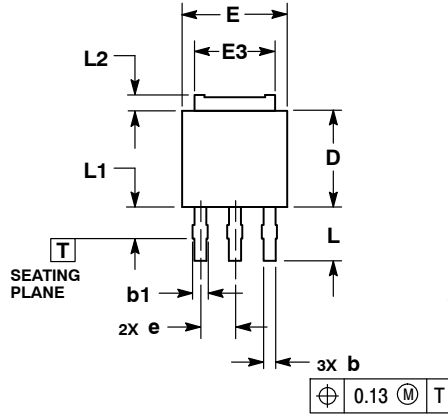
3.5 MM IPAK, STRAIGHT LEAD

CASE 369AD

ISSUE B

DATE 18 APR 2013

SCALE 1:1



OPTIONAL CONSTRUCTION

NOTES:

- 1.. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
- 2.. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30mm FROM TERMINAL TIP.
4. 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 |

GENERIC MARKING DIAGRAMS*

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

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

STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 5:
PIN 1. GATE
2. ANODE
3. CATHODE
4. ANODE

STYLE 6:
PIN 1. MT1
2. MT2
3. GATE
4. MT2

STYLE 7:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR



- XXXXXX = Device Code
- A = Assembly Location
- L = Wafer Lot
- Y = Year
- WW = Work Week
- G = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

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|-------------------------|-----------------------------------|--|
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| DESCRIPTION: | 3.5 MM IPAK, STRAIGHT LEAD | PAGE 1 OF 1 |

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