

# NTD14N03R, NVD14N03R

## MOSFET – Power, N-Channel, DPAK

**14 A, 25 V**

### Features

- Planar HD3e Process for Fast Switching Performance
- Low  $R_{DS(on)}$  to Minimize Conduction Loss
- Low  $C_{iss}$  to Minimize Driver Loss
- Low Gate Charge
- Optimized for High Side Switching Requirements in High-Efficiency DC-DC Converters
- NVD and SVD Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

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

| Parameter                                                                      | Symbol          | Value          | Unit               |
|--------------------------------------------------------------------------------|-----------------|----------------|--------------------|
| Drain-to-Source Voltage                                                        | $V_{DSS}$       | 25             | Vdc                |
| Gate-to-Source Voltage – Continuous                                            | $V_{GS}$        | $\pm 20$       | Vdc                |
| Thermal Resistance – Junction-to-Case                                          | $R_{\theta JC}$ | 6.0            | $^\circ\text{C/W}$ |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$                             | $P_D$           | 20.8           | W                  |
| Drain Current – Continuous @ $T_A = 25^\circ\text{C}$ , Chip                   | $I_D$           | 14             | A                  |
| – Continuous @ $T_A = 25^\circ\text{C}$ , Limited by Package                   | $I_D$           | 11.4           | A                  |
| – Single Pulse ( $t_p \leq 10 \mu\text{s}$ )                                   | $I_D$           | 28             | A                  |
| Thermal Resistance, Junction-to-Ambient (Note 1)                               | $R_{\theta JA}$ | 80             | $^\circ\text{C/W}$ |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$                             | $P_D$           | 1.56           | W                  |
| Drain Current – Continuous @ $T_A = 25^\circ\text{C}$                          | $I_D$           | 3.1            | A                  |
| Thermal Resistance, Junction-to-Ambient (Note 2)                               | $R_{\theta JA}$ | 120            | $^\circ\text{C/W}$ |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$                             | $P_D$           | 1.04           | W                  |
| Drain Current – Continuous @ $T_A = 25^\circ\text{C}$                          | $I_D$           | 2.5            | A                  |
| Operating and Storage Temperature Range                                        | $T_J, T_{stg}$  | $-55$ to $150$ | $^\circ\text{C}$   |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds | $T_L$           | 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.

1. When surface mounted to an FR4 board using 0.5 sq. in pad size.
2. When surface mounted to an FR4 board using minimum recommended pad size.

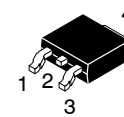
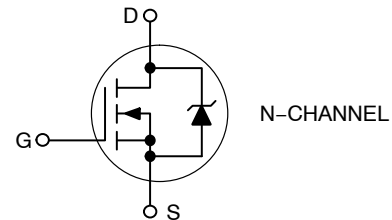


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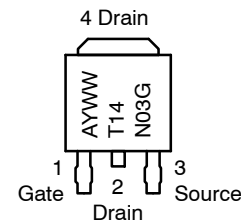
**14 AMPERES, 25 VOLTS**

**$R_{DS(on)} = 70.4 \text{ m}\Omega$  (Typ)**



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

### MARKING DIAGRAM & PIN ASSIGNMENTS



A = Assembly Location\*  
Y = Year  
WW = Work Week  
14N03 = Device Code  
G = Pb-Free Package

\* The Assembly Location code (A) is front side optional. In cases where the Assembly Location is stamped in the package, the front side assembly code may be blank.

### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

# NTD14N03R, NVD14N03R

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

| Characteristics | Symbol | Min | Typ | Max | Unit |
|-----------------|--------|-----|-----|-----|------|
|-----------------|--------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|                                                                                                                                                                                 |               |         |         |           |                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------|---------|-----------|-----------------------------|
| Drain-to-Source Breakdown Voltage (Note 3)<br>( $V_{GS} = 0\text{ Vdc}$ , $I_D = 250\text{ }\mu\text{Adc}$ )<br>Temperature Coefficient (Positive)                              | $V_{(br)DSS}$ | 25<br>– | 28<br>– | –<br>–    | Vdc<br>mV/ $^\circ\text{C}$ |
| Zero Gate Voltage Drain Current<br>( $V_{DS} = 20\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )<br>( $V_{DS} = 20\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ , $T_J = 150^\circ\text{C}$ ) | $I_{DSS}$     | –<br>–  | –<br>–  | 1.0<br>10 | $\mu\text{Adc}$             |
| Gate-Body Leakage Current<br>( $V_{GS} = \pm 20\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )                                                                                         | $I_{GSS}$     | –       | –       | $\pm 100$ | nAdc                        |

### ON CHARACTERISTICS (Note 3)

|                                                                                                                                                              |              |          |             |           |                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|-------------|-----------|-----------------------------|
| Gate Threshold Voltage (Note 3)<br>( $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{Adc}$ )<br>Threshold Temperature Coefficient (Negative)                  | $V_{GS(th)}$ | 1.0<br>– | 1.5<br>–    | 2.0<br>–  | Vdc<br>mV/ $^\circ\text{C}$ |
| Static Drain-to-Source On-Resistance (Note 3)<br>( $V_{GS} = 4.5\text{ Vdc}$ , $I_D = 5\text{ Adc}$ )<br>( $V_{GS} = 10\text{ Vdc}$ , $I_D = 5\text{ Adc}$ ) | $R_{DS(on)}$ | –<br>–   | 117<br>70.4 | 130<br>95 | m $\Omega$                  |
| Forward Transconductance (Note 3)<br>( $V_{DS} = 10\text{ Vdc}$ , $I_D = 5\text{ Adc}$ )                                                                     | $g_{FS}$     | –        | 7.0         | –         | Mhos                        |

### DYNAMIC CHARACTERISTICS

|                      |                                                                          |           |   |     |   |    |
|----------------------|--------------------------------------------------------------------------|-----------|---|-----|---|----|
| Input Capacitance    | $(V_{DS} = 20\text{ Vdc}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$ ) | $C_{iss}$ | – | 115 | – | pF |
| Output Capacitance   |                                                                          | $C_{oss}$ | – | 62  | – |    |
| Transfer Capacitance |                                                                          | $C_{rss}$ | – | 33  | – |    |

### SWITCHING CHARACTERISTICS (Note 4)

|                     |                                                                                                            |              |   |     |   |    |
|---------------------|------------------------------------------------------------------------------------------------------------|--------------|---|-----|---|----|
| Turn-On Delay Time  | $(V_{GS} = 10\text{ Vdc}$ , $V_{DD} = 10\text{ Vdc}$ ,<br>$I_D = 5\text{ Adc}$ , $R_G = 3\text{ }\Omega$ ) | $t_{d(on)}$  | – | 3.8 | – | ns |
| Rise Time           |                                                                                                            | $t_r$        | – | 27  | – |    |
| Turn-Off Delay Time |                                                                                                            | $t_{d(off)}$ | – | 9.6 | – |    |
| Fall Time           |                                                                                                            | $t_f$        | – | 2.0 | – |    |
| Gate Charge         | $(V_{GS} = 5\text{ Vdc}$ , $I_D = 5\text{ Adc}$ ,<br>$V_{DS} = 10\text{ Vdc}$ ) (Note 3)                   | $Q_T$        | – | 1.8 | – | nC |
|                     |                                                                                                            | $Q_1$        | – | 0.8 | – |    |
|                     |                                                                                                            | $Q_2$        | – | 0.7 | – |    |

### SOURCE-DRAIN DIODE CHARACTERISTICS

|                                |                                                                                                                                             |          |        |              |          |               |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|----------|--------|--------------|----------|---------------|
| Forward On-Voltage             | $(I_S = 5\text{ Adc}$ , $V_{GS} = 0\text{ Vdc}$ ) (Note 3)<br>$(I_S = 5\text{ Adc}$ , $V_{GS} = 0\text{ Vdc}$ , $T_J = 125^\circ\text{C}$ ) | $V_{SD}$ | –<br>– | 0.93<br>0.82 | 1.2<br>– | Vdc           |
| Reverse Recovery Time          | $(I_S = 5\text{ Adc}$ , $V_{GS} = 0\text{ Vdc}$ ,<br>$di_S/dt = 100\text{ A}/\mu\text{s}$ ) (Note 3)                                        | $t_{rr}$ | –      | 6.6          | –        | ns            |
|                                |                                                                                                                                             | $t_a$    | –      | 4.75         | –        |               |
|                                |                                                                                                                                             | $t_b$    | –      | 1.88         | –        |               |
| Reverse Recovery Stored Charge |                                                                                                                                             | $Q_{RR}$ | –      | 0.002        | –        | $\mu\text{C}$ |

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.

3. Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

4. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

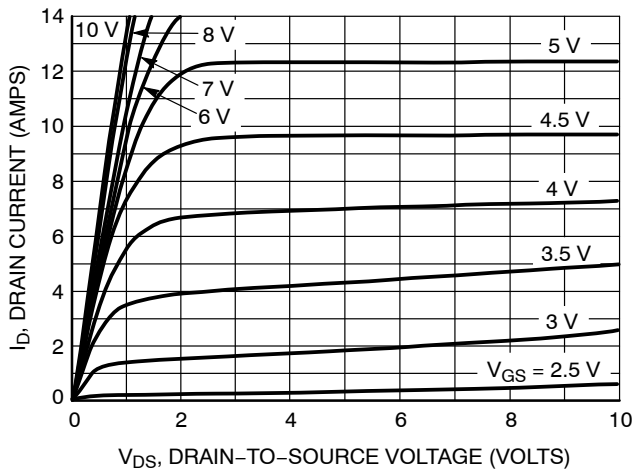


Figure 1. On-Region Characteristics

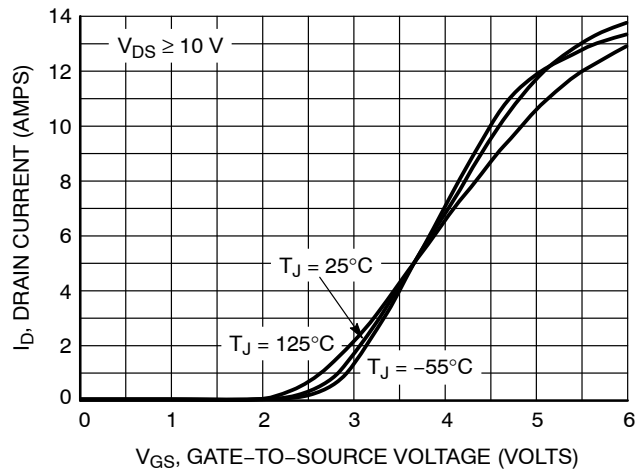


Figure 2. Transfer Characteristics

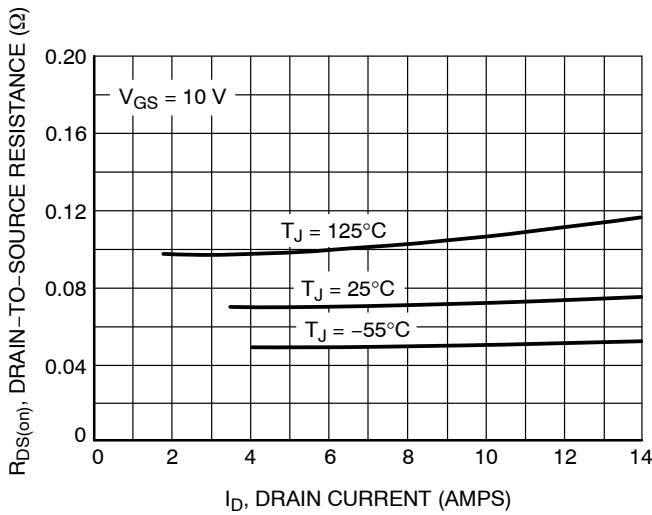


Figure 3. On-Resistance versus Drain Current and Temperature

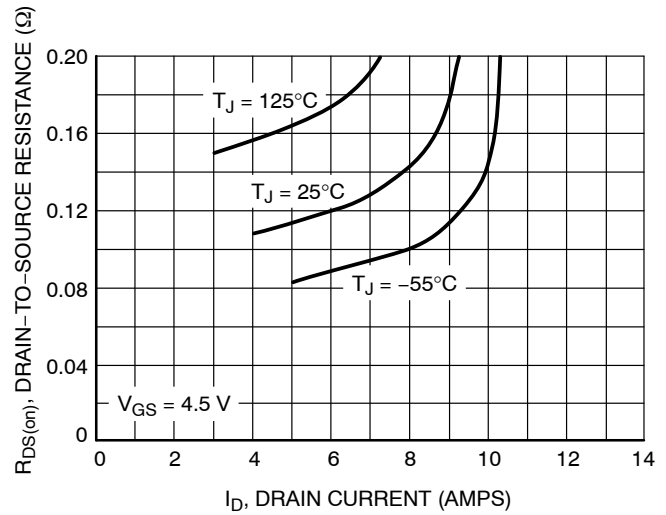


Figure 4. On-Resistance versus Drain Current and Temperature

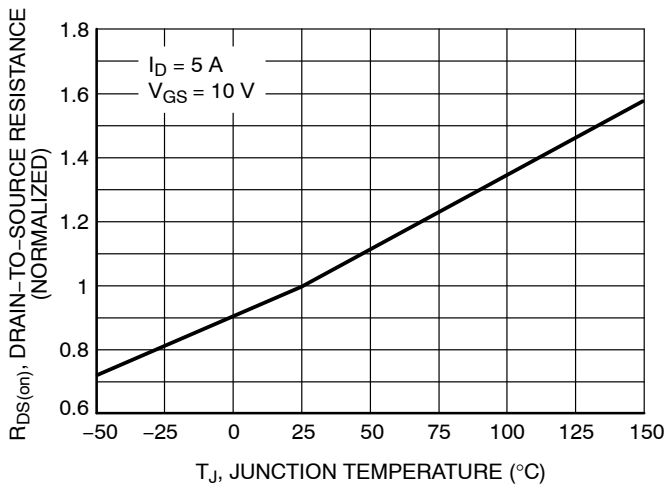


Figure 5. On-Resistance Variation with Temperature

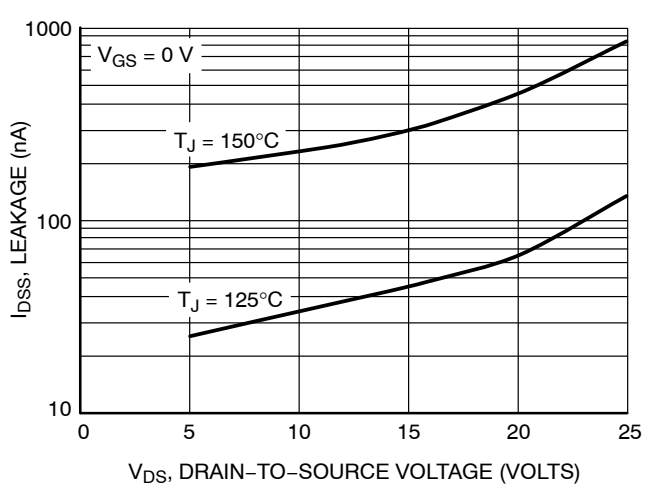


Figure 6. Drain-to-Source Leakage Current versus Voltage

# NTD14N03R, NVD14N03R

## TYPICAL CHARACTERISTICS

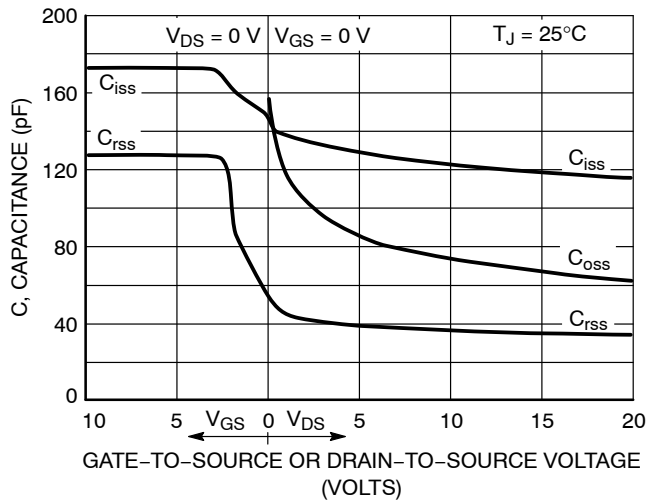


Figure 7. Capacitance Variation

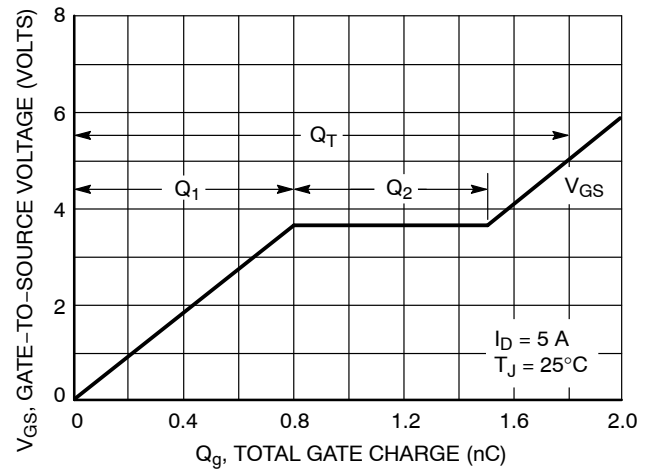


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

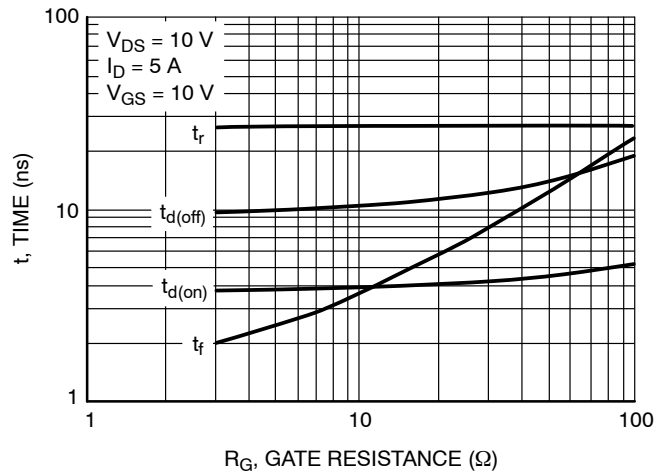


Figure 9. Resistive Switching Time Variation versus Gate Resistance

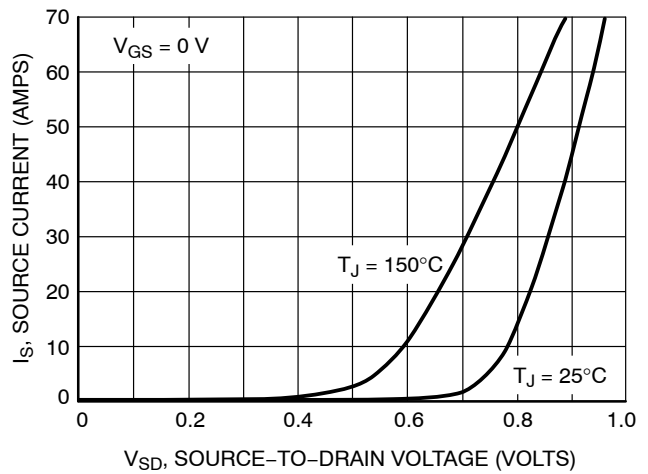


Figure 10. Diode Forward Voltage versus Current

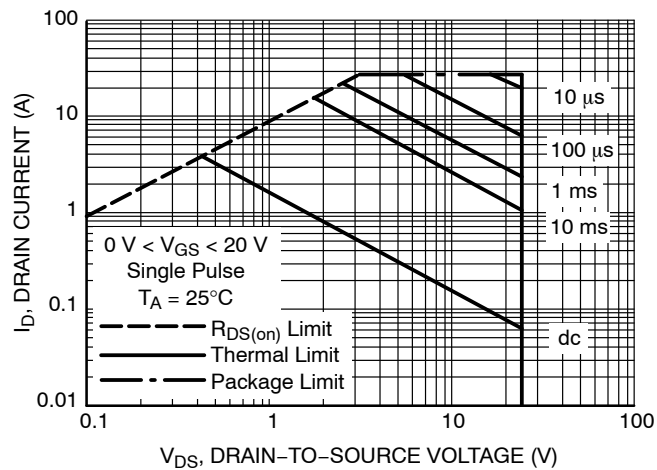
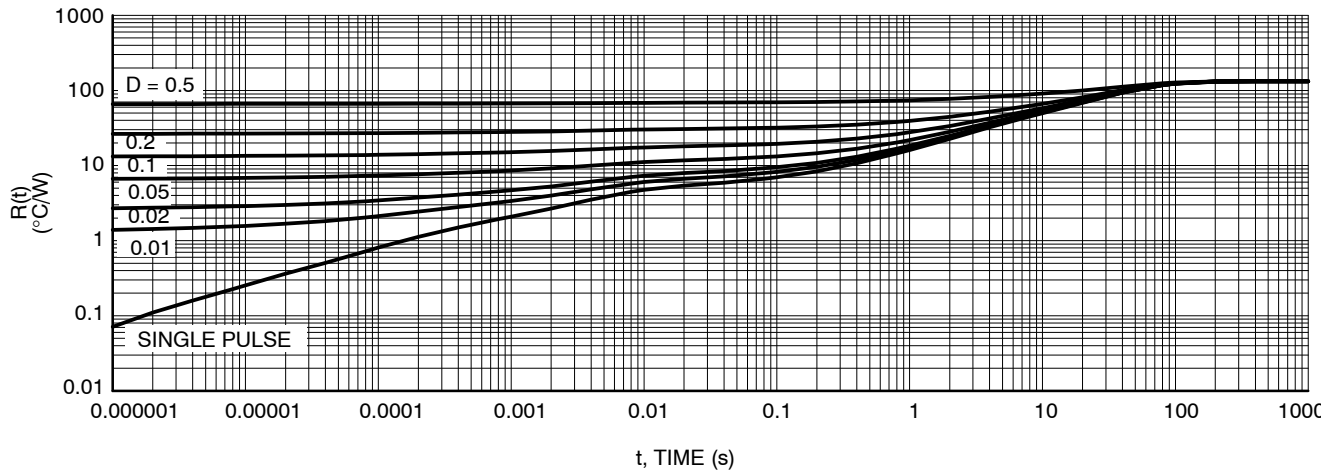


Figure 11. Maximum Rated Forward Biased Safe Operating Area

# NTD14N03R, NVD14N03R

## TYPICAL CHARACTERISTICS



**Figure 12. Thermal Response**

### ORDERING INFORMATION

| Device        | Package           | Shipping <sup>†</sup> |
|---------------|-------------------|-----------------------|
| NTD14N03RT4G  | DPAK<br>(Pb-Free) | 2500 / Tape & Reel    |
| NVD14N03RT4G* | DPAK<br>(Pb-Free) | 2500 / Tape & Reel    |
| SVD14N03RT4G* | DPAK<br>(Pb-Free) | 2500 / Tape & Reel    |

<sup>†</sup>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.

\*NVD and SVD Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

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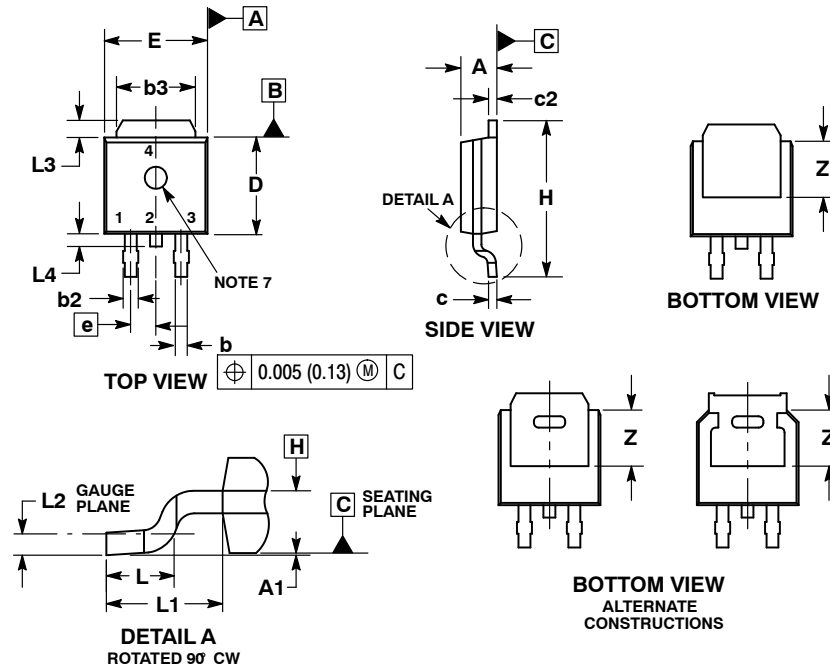
ON



SCALE 1:1

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

DATE 21 JUL 2015



### 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 | 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     | ---   |

### GENERIC MARKING DIAGRAM\*

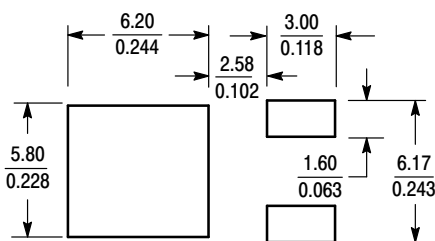


XXXXXX = Device Code  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
WW = Work Week  
G = Pb-Free Package

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

- 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
- STYLE 8:**  
PIN 1. N/C  
2. CATHODE  
3. ANODE  
4. CATHODE
- STYLE 9:**  
PIN 1. ANODE  
2. CATHODE  
3. RESISTOR ADJUST  
4. CATHODE
- STYLE 10:**  
PIN 1. CATHODE  
2. ANODE  
3. CATHODE  
4. ANODE

### 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, SOLDERM/D.

|                         |                            |                                                                                                                                                                                     |
|-------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <b>DESCRIPTION:</b>     | <b>DPAK (SINGLE GAUGE)</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                                  |

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