



**THE DATASHEET OF  
NTGS3136PT1G**



# NTGS3136P, NVGS3136P

## MOSFET – Power, Single, P-Channel, TSOP-6 -20 V, -5.8 A

### Features

- Low  $R_{DS(on)}$  in TSOP-6 Package
- 1.8 V Gate Rating
- Fast Switching
- NV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

- Optimized for Battery and Load Management Applications in Portable Equipment
- High Side Load Switch
- Switching Circuits for Game Consoles, Camera Phone, etc.

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

| Parameter   |                        | Symbol                   | Value      | Unit             |   |
|---|------------------------|--------------------------|------------|------------------|---|
| Drain-to-Source Voltage   |                        | $V_{DS}$                 | -20        | V                |   |
| Gate-to-Source Voltage  |                        | $V_{GS}$                 | $\pm 8.0$  | V                |   |
| Continuous Drain Current (Note 1)                                 | Steady State           | $T_A = 25^\circ\text{C}$ | $I_D$      | -5.1             | A |
|   |                        | $T_A = 85^\circ\text{C}$ |            | -3.6             |   |
|   | $t \leq 5 \text{ s}$   | $T_A = 25^\circ\text{C}$ |            | -5.8             |   |
| Power Dissipation (Note 1)  | Steady State           | $T_A = 25^\circ\text{C}$ | $P_D$      | 1.25             | W |
|   | $t \leq 5 \text{ s}$   |                          |            | 1.6              |   |
| Continuous Drain Current (Note 2)                                 | Steady State           | $T_A = 25^\circ\text{C}$ | $I_D$      | -3.7             | A |
|   |                        | $T_A = 85^\circ\text{C}$ |            | -2.7             |   |
| Power Dissipation (Note 2)  | Steady State           | $T_A = 25^\circ\text{C}$ | $P_D$      | 0.7              | W |
| Pulsed Drain Current  | $t_p = 10 \mu\text{s}$ | $I_{DM}$                 | -20        | A                |   |
| Operating Junction and Storage Temperature                        |                        | $T_J, T_{STG}$           | -55 to 150 | $^\circ\text{C}$ |   |
| 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.

1. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces)
2. Surface-mounted on FR4 board using the minimum recommended pad size (Cu area = 0.0775 in sq).

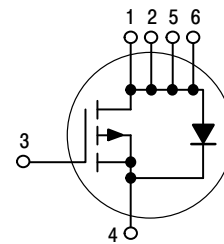


ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

| $V_{(BR)DSS}$ | $R_{DS(ON)}$ TYP       | $I_D$ MAX |
|---------------|------------------------|-----------|
| -20 V         | 25 m $\Omega$ @ -4.5 V | -5.1 A    |
|               | 32 m $\Omega$ @ -2.5 V | -4.5 A    |
|               | 41 m $\Omega$ @ -1.8 V | -2.5 A    |

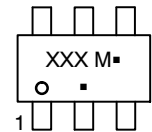
### P-Channel



### MARKING DIAGRAM



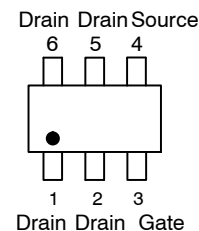
TSOP-6  
CASE 318G  
STYLE 1



XXX = Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### PIN ASSIGNMENT



### ORDERING INFORMATION

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

# NTGS3136P, NVGS3136P

## THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter                                   | Symbol          | Value | Unit |
|---|-----------------|-------|------|
| Junction-to-Ambient – Steady State (Note 3) | $R_{\theta JA}$ | 100   | °C/W |
| Junction-to-Ambient – $t = 5$ s (Note 3)    | $R_{\theta JA}$ | 77    |      |
| Junction-to-Ambient – Steady State (Note 4) | $R_{\theta JA}$ | 185   |      |

3. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces)  
 4. Surface-mounted on FR4 board using the minimum recommended pad size (Cu area = 0.0775 in sq).

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

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

### OFF CHARACTERISTICS

|   |                   |   |     |     |           |               |
|---|-------------------|---|-----|-----|-----------|---------------|
| Drain-to-Source Breakdown Voltage                         | $V_{(BR)DSS}$     | $V_{GS} = 0$ V, $I_D = -250$ $\mu\text{A}$                | -20 |     |           | V             |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $I_D = -250$ $\mu\text{A}$ , Reference $25^\circ\text{C}$ |     | -13 |           | mV/°C         |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | $V_{GS} = 0$ V,<br>$V_{DS} = -20$ V                       |     |     | -1.0      | $\mu\text{A}$ |
|   |                   | $T_J = 25^\circ\text{C}$                                  |     |     |           |               |
|   |                   | $T_J = 85^\circ\text{C}$                                  |     |     | -5.0      |               |
| Gate-to-Source Leakage Current                            | $I_{GSS}$         | $V_{DS} = 0$ V, $V_{GS} = \pm 8.0$ V                      |     |     | $\pm 0.1$ | $\mu\text{A}$ |

### ON CHARACTERISTICS (Note 5)

|  |                  |  |      |    |      |            |
|--|------------------|--|------|----|------|------------|
| Gate Threshold Voltage                     | $V_{GS(TH)}$     | $V_{GS} = V_{DS}$ , $I_D = -250$ $\mu\text{A}$ | -0.4 |    | -1.0 | V          |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ |  |      | 3  |      | mV/°C      |
| Drain-to-Source On Resistance              | $R_{DS(on)}$     | $V_{GS} = -4.5$ V, $I_D = -5.1$ A              |      | 25 | 33   | m $\Omega$ |
|  |                  | $V_{GS} = -2.5$ V, $I_D = -4.5$ A              |      | 32 | 40   |            |
|  |                  | $V_{GS} = -1.8$ V, $I_D = -2.5$ A              |      | 41 | 51   |            |
| Forward Transconductance                   | $g_{FS}$         | $V_{DS} = -5.0$ V, $I_D = -5.1$ A              |      | 22 |      | S          |

### CHARGES, CAPACITANCES AND GATE RESISTANCE

|                              |              |  |  |      |    |    |
|------------------------------|--------------|--|--|------|----|----|
| Input Capacitance            | $C_{ISS}$    | $V_{GS} = 0$ V, $f = 1$ MHz, $V_{DS} = -10$ V          |  | 1901 |    | pF |
| Output Capacitance           | $C_{OSS}$    |  |  | 274  |    |    |
| Reverse Transfer Capacitance | $C_{RSS}$    |  |  | 175  |    |    |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = -4.5$ V, $V_{DS} = -10$ V;<br>$I_D = -5.1$ A |  | 18   | 29 | nC |
| Threshold Gate Charge        | $Q_{G(TH)}$  |  |  | 0.7  |    |    |
| Gate-to-Source Charge        | $Q_{GS}$     |  |  | 2.4  |    |    |
| Gate-to-Drain Charge         | $Q_{GD}$     |  |  | 4.3  |    |    |
| Gate Resistance              | $R_G$        |  |  | 7.6  |    |    |

### SWITCHING CHARACTERISTICS (Note 6)

|                     |              |  |  |    |     |    |
|---------------------|--------------|--|--|----|-----|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = -4.5$ V, $V_{DD} = -10$ V,<br>$I_D = -1.0$ A, $R_G = 6.0$ $\Omega$ |  | 9  | 19  | ns |
| Rise Time           | $T_r$        |  |  | 9  | 19  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |  |  | 99 | 160 |    |
| Fall Time           | $T_f$        |  |  | 48 | 79  |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                       |          |  |                           |      |      |    |
|-----------------------|----------|--|---------------------------|------|------|----|
| Forward Diode Voltage | $V_{SD}$ | $V_{GS} = 0$ V,<br>$I_S = -1.7$ A                                    | $T_J = 25^\circ\text{C}$  | -0.7 | -1.2 | V  |
|                       |          |  | $T_J = 125^\circ\text{C}$ | -0.6 |      |    |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS} = 0$ V, $dI_S/dt = 100$ A/ $\mu\text{s}$ ,<br>$I_S = -1.7$ A |                           | 37   | 60   | ns |

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. Pulse Test: pulse width  $\leq 300$   $\mu\text{s}$ , duty cycle  $\leq 2\%$   
 6. Switching characteristics are independent of operating junction temperatures

# NTGS3136P, NVGS3136P

## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

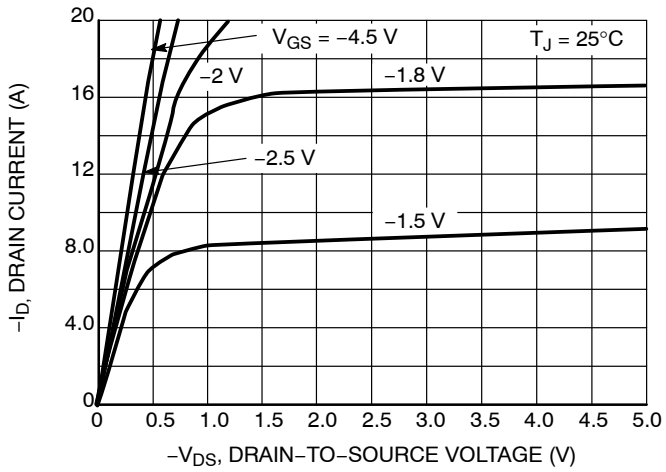


Figure 1. On-Region Characteristics

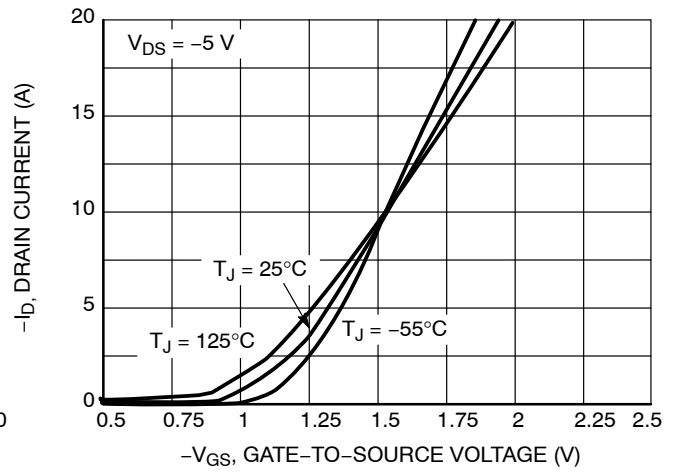


Figure 2. Transfer Characteristics

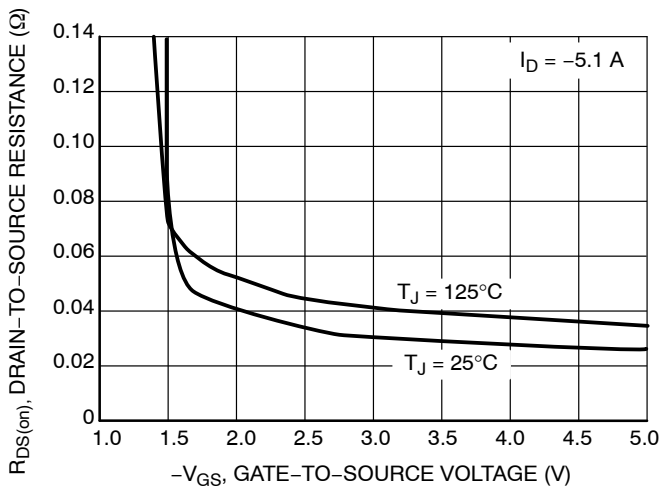


Figure 3. On-Resistance vs. Gate-to-Source Voltage

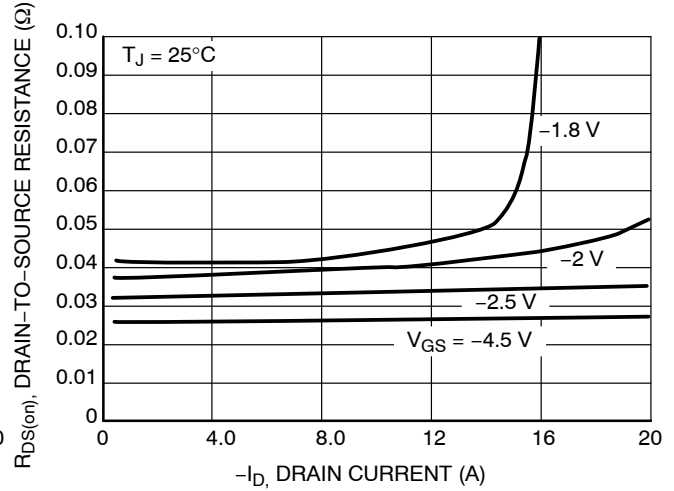


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

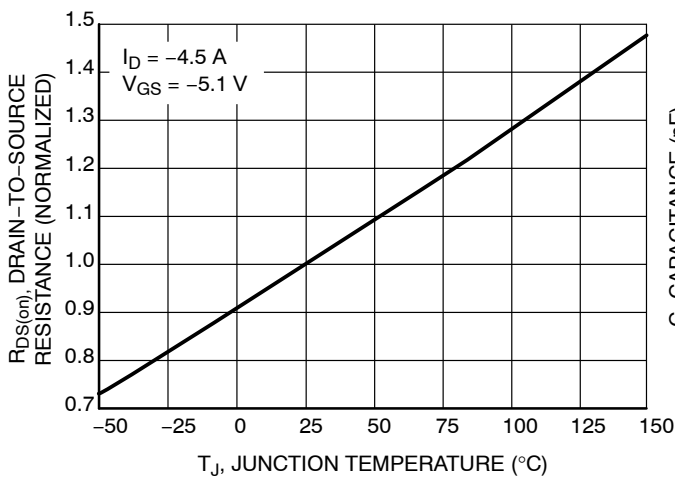


Figure 5. On-Resistance Variation with Temperature

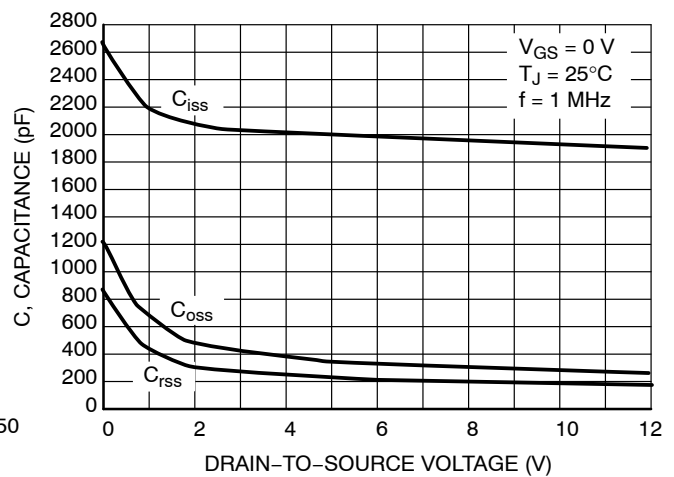
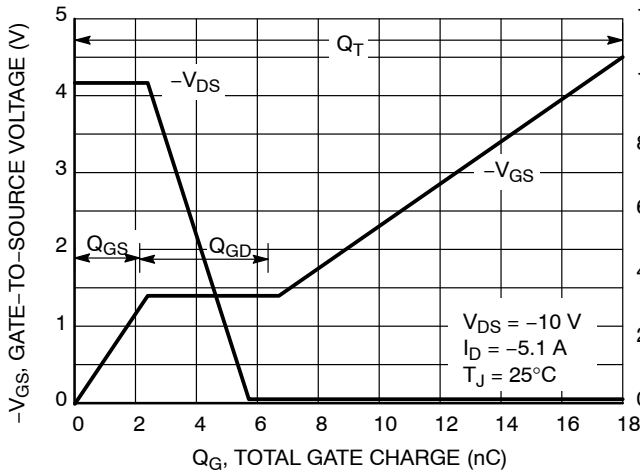


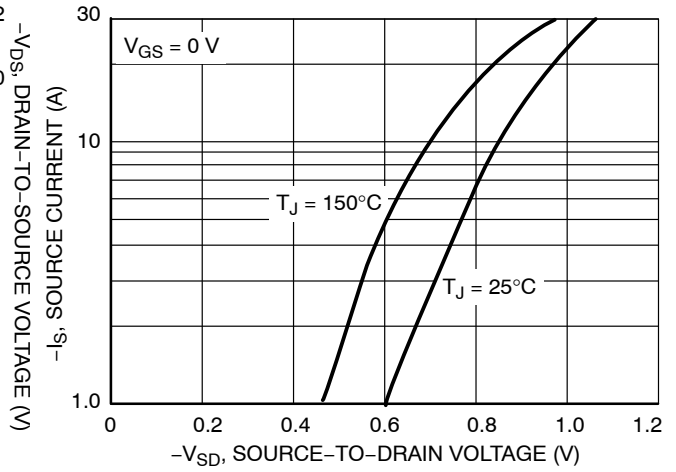
Figure 6. Capacitance Variation

# NTGS3136P, NVGS3136P

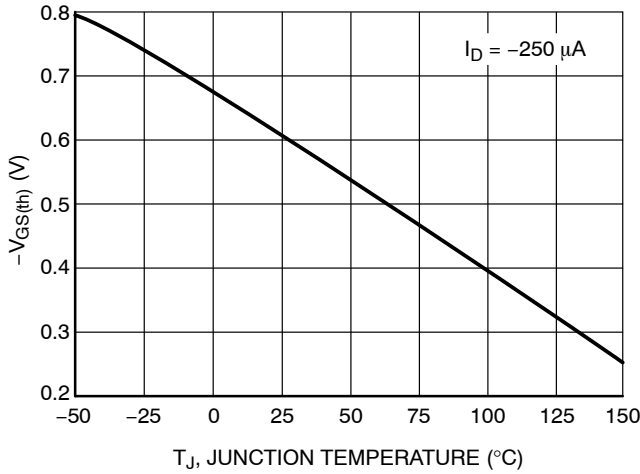
## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)



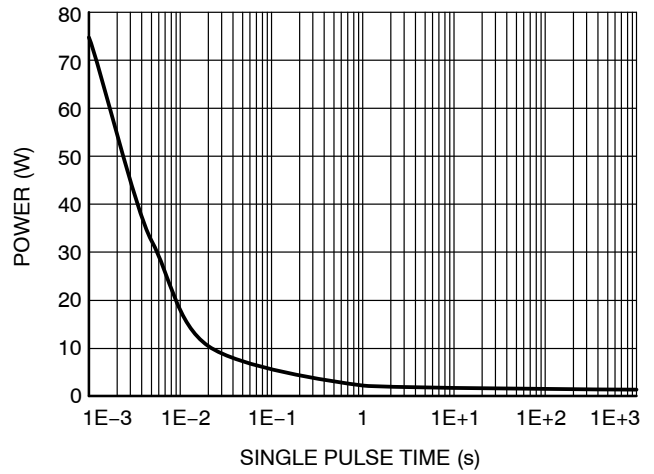
**Figure 7. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



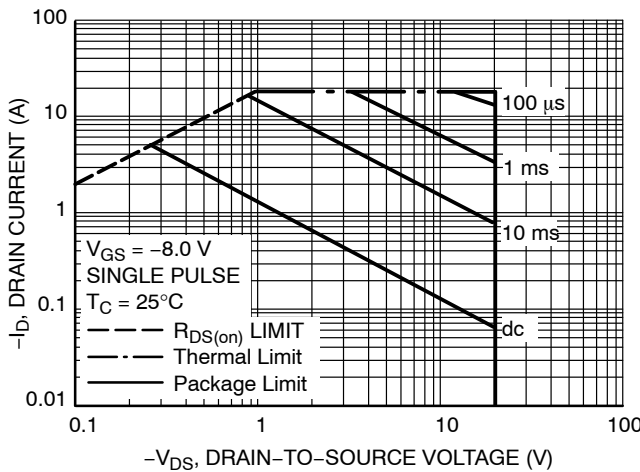
**Figure 8. Diode Forward Voltage vs. Current**



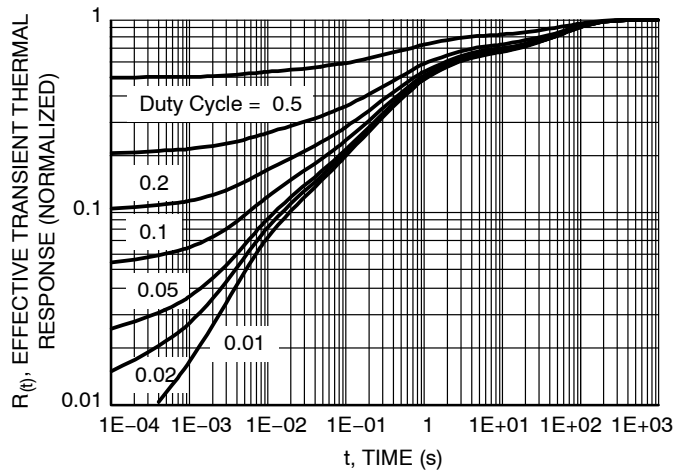
**Figure 9. Threshold Voltage**



**Figure 10. Single Pulse Maximum Power Dissipation**



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**



**Figure 12. FET Thermal Response**

# NTGS3136P, NVGS3136P

## ORDERING INFORMATION

| Device        | Marking | Package             | Shipping†          |
|---------------|---------|---------------------|--------------------|
| NTGS3136PT1G  | SD      | TSOP-6<br>(Pb-Free) | 3000 / Tape & Reel |
| NVGS3136PT1G* | VSD     |                     |                    |

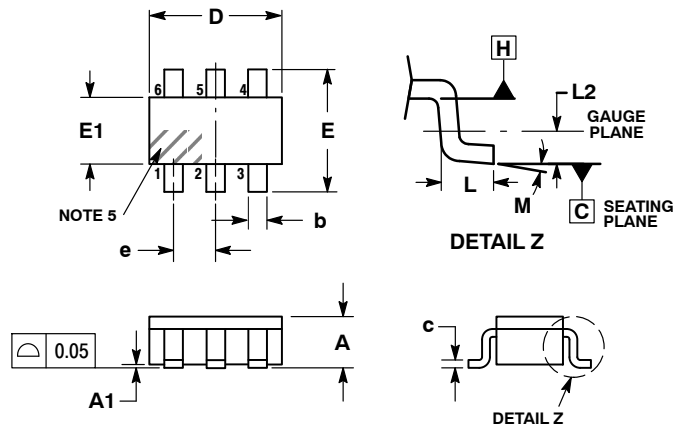
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

# NTGS3136P, NVGS3136P

## PACKAGE DIMENSIONS

### TSOP-6 CASE 318G-02 ISSUE V



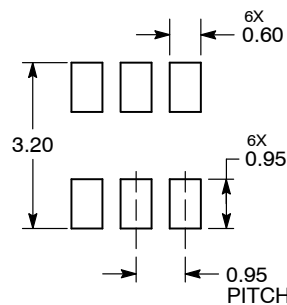
#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSIONS D AND E1 ARE DETERMINED AT DATUM H.
5. PIN ONE INDICATOR MUST BE LOCATED IN THE INDICATED ZONE.

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN         | NOM  | MAX  |
| A   | 0.90        | 1.00 | 1.10 |
| A1  | 0.01        | 0.06 | 0.10 |
| b   | 0.25        | 0.38 | 0.50 |
| c   | 0.10        | 0.18 | 0.26 |
| D   | 2.90        | 3.00 | 3.10 |
| E   | 2.50        | 2.75 | 3.00 |
| E1  | 1.30        | 1.50 | 1.70 |
| e   | 0.85        | 0.95 | 1.05 |
| L   | 0.20        | 0.40 | 0.60 |
| L2  | 0.25 BSC    |      |      |
| M   | 0°          | -    | 10°  |

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

### RECOMMENDED SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

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

ON Semiconductor and the are registered trademarks of Semiconductor Components Industries, LLC (SCILLC) or its subsidiaries in the United States and/or other countries. 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-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.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](mailto: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](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative

## Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View NTGS3136PT1G on WIN SOURCE](#)

 [ON Semiconductor](#) Information

## Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management