

# NTD5407N

## Power MOSFET

40 V, 38 A, Single N-Channel, DPAK

### Features

- Low  $R_{DS(on)}$
- High Current Capability
- Low Gate Charge
- These are Pb-Free Devices

### Applications

- Electronic Brake Systems
- Electronic Power Steering
- Bridge Circuits

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

| Parameter   |              | Symbol         | Value                     | Units            |   |
|---|--------------|----------------|---------------------------|------------------|---|
| Drain-to-Source Voltage   |              | $V_{DSS}$      | 40                        | V                |   |
| Gate-to-Source Voltage  |              | $V_{GS}$       | $\pm 20$                  | V                |   |
| Continuous Drain Current – $R_{\theta JC}$ (Note 1)   | Steady State | $I_D$          | $T_C = 25^\circ\text{C}$  | 38               | A |
|   |              |                | $T_C = 100^\circ\text{C}$ | 27               |   |
| Power Dissipation – $R_{\theta JC}$ (Note 1)  | Steady State | $P_D$          | 75                        | W                |   |
| Pulsed Drain Current  |              | $I_{DM}$       | 75                        | A                |   |
| Operating Junction and Storage Temperature  |              | $T_J, T_{STG}$ | -55 to 175                | $^\circ\text{C}$ |   |
| Source Current (Body Diode)   |              | $I_S$          | 36                        | A                |   |
| Single Pulse Drain-to-Source Avalanche Energy – ( $V_{DD} = 50\text{ V}, V_{GS} = 10\text{ V}, I_{PK} = 17\text{ A}, L = 1\text{ mH}, R_G = 25\ \Omega$ ) |              | EAS            | 150                       | mJ               |   |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s)   |              | $T_L$          | 260                       | $^\circ\text{C}$ |   |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

### THERMAL RESISTANCE RATINGS (Note 1)

| Parameter                | Symbol          | Max | Units              |
|--------------------------|-----------------|-----|--------------------|
| Junction-to-Case (Drain) | $R_{\theta JC}$ | 2.0 | $^\circ\text{C/W}$ |

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

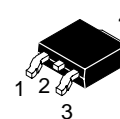
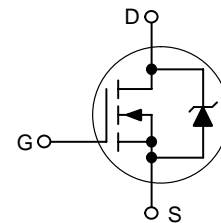


ON Semiconductor®

<http://onsemi.com>

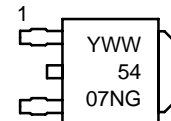
| $V_{(BR)DSS}$ | $R_{DS(ON)}$ TYP     | $I_D$ MAX (Note 1) |
|---------------|----------------------|--------------------|
| 40 V          | 21 m $\Omega$ @ 10 V | 38 A               |

### N-Channel



DPAK  
CASE 369C  
STYLE 2

### MARKING DIAGRAM



Y = Year  
WW = Work Week  
5407N = Specific Device Code  
G = Pb-Free Device

### ORDERING INFORMATION

| Device      | Package        | Shipping†          |
|-------------|----------------|--------------------|
| NTD5407NG   | DPAK (Pb-Free) | 75 Units / Rail    |
| NTD5407NT4G | 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.

# NTD5407N

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise stated)

| Parameter   | Symbol                               | Test Condition                                 | Min                    | Typ | Max  | Unit  |
|---|--------------------------------------|--|------------------------|-----|------|-------|
| <b>OFF CHARACTERISTICS</b>                                |                                      |  |                        |     |      |       |
| Drain-to-Source Breakdown Voltage                         | V <sub>(BR)DSS</sub>                 | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA | 40                     |     |      | V     |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V <sub>(BR)DSS</sub> /T <sub>J</sub> |  |                        | 39  |      | mV/°C |
| Zero Gate Voltage Drain Current                           | I <sub>DSS</sub>                     | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 40 V  | T <sub>J</sub> = 25°C  |     | 1.0  | μA    |
|   |                                      |  | T <sub>J</sub> = 100°C |     | 10   |       |
| Gate-to-Source Leakage Current                            | I <sub>GSS</sub>                     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±30 V |                        |     | ±100 | nA    |

## ON CHARACTERISTICS (Note 2)

|  |                                     |   |     |      |     |       |
|--|-------------------------------------|---|-----|------|-----|-------|
| Gate Threshold Voltage                 | V <sub>GS(TH)</sub>                 | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA | 1.5 |      | 3.5 | V     |
| Gate Threshold Temperature Coefficient | V <sub>GS(TH)</sub> /T <sub>J</sub> |   |     | -6.0 |     | mV/°C |
| Drain-to-Source On Resistance          | R <sub>DS(on)</sub>                 | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A               |     | 21   | 26  | mΩ    |
|  |                                     | V <sub>GS</sub> = 5.0 V, I <sub>D</sub> = 10 A              |     | 32   | 40  |       |
| Forward Transconductance               | g <sub>FS</sub>                     | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 18 A               |     | 15   |     | S     |

## CHARGES AND CAPACITANCES

|                              |                     |   |  |      |      |    |
|------------------------------|---------------------|---|--|------|------|----|
| Input Capacitance            | C <sub>ISS</sub>    | V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = 32 V            |  | 615  | 1000 | pF |
| Output Capacitance           | C <sub>OSS</sub>    |   |  | 173  |      |    |
| Reverse Transfer Capacitance | C <sub>RSS</sub>    |   |  | 80   |      |    |
| Total Gate Charge            | Q <sub>G(TOT)</sub> | V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 32 V, I <sub>D</sub> = 38 A |  | 20   |      | nC |
| Gate-to-Source Charge        | Q <sub>GS</sub>     |   |  | 2.25 |      |    |
| Gate-to-Drain Charge         | Q <sub>GD</sub>     |   |  | 10.5 |      |    |

## SWITCHING CHARACTERISTICS, V<sub>GS</sub> = 10 V (Note 3)

|                     |                     |   |  |     |  |    |
|---------------------|---------------------|---|--|-----|--|----|
| Turn-On Delay Time  | t <sub>d(ON)</sub>  | V <sub>GS</sub> = 10 V, V <sub>DD</sub> = 32 V, I <sub>D</sub> = 38 A, R <sub>G</sub> = 2.5 Ω |  | 6.8 |  | ns |
| Rise Time           | t <sub>r</sub>      |   |  | 17  |  |    |
| Turn-Off Delay Time | t <sub>d(OFF)</sub> |   |  | 66  |  |    |
| Fall Time           | t <sub>f</sub>      |   |  | 51  |  |    |

## SWITCHING CHARACTERISTICS, V<sub>GS</sub> = 5 V (Note 3)

|                     |                     |  |  |     |  |    |
|---------------------|---------------------|--|--|-----|--|----|
| Turn-On Delay Time  | t <sub>d(ON)</sub>  | V <sub>GS</sub> = 5 V, V <sub>DD</sub> = 20 V, I <sub>D</sub> = 20 A, R <sub>G</sub> = 2.5 Ω |  | 10  |  | ns |
| Rise Time           | t <sub>r</sub>      |  |  | 175 |  |    |
| Turn-Off Delay Time | t <sub>d(OFF)</sub> |  |  | 13  |  |    |
| Fall Time           | t <sub>f</sub>      |  |  | 23  |  |    |

## DRAIN-SOURCE DIODE CHARACTERISTICS (Note 2)

|                         |                 |  |                        |      |      |     |    |
|-------------------------|-----------------|--|------------------------|------|------|-----|----|
| Forward Diode Voltage   | V <sub>SD</sub> | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 5.0 A                                | T <sub>J</sub> = 25°C  |      | 0.9  | 1.1 | V  |
|                         |                 |  | T <sub>J</sub> = 125°C |      | 0.75 |     |    |
| Reverse Recovery Time   | t <sub>RR</sub> | V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs, I <sub>S</sub> = 15 A |                        | 38   |      | ns  |    |
| Charge Time             | t <sub>a</sub>  |  |                        | 20.5 |      |     |    |
| Discharge Time          | t <sub>b</sub>  |  |                        | 17   |      |     |    |
| Reverse Recovery Charge | Q <sub>RR</sub> |  |                        | 40   |      |     | nC |

- Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
- Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

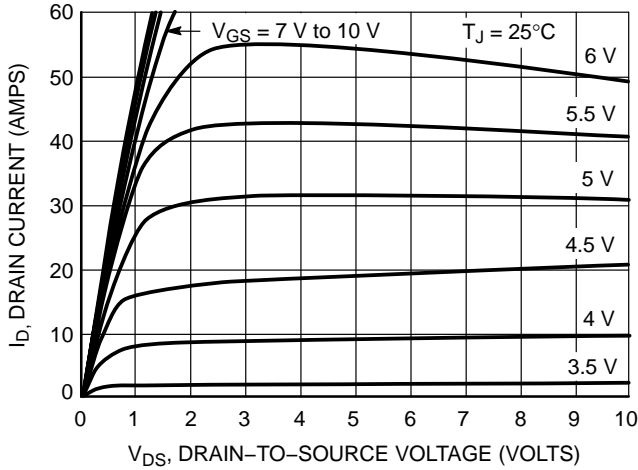


Figure 1. On-Region Characteristics

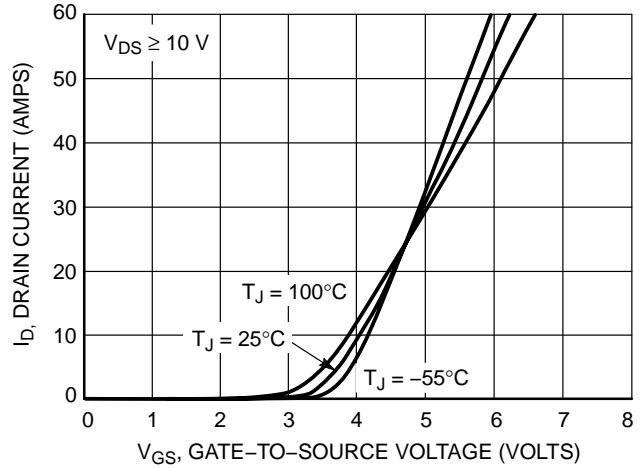


Figure 2. Transfer Characteristics

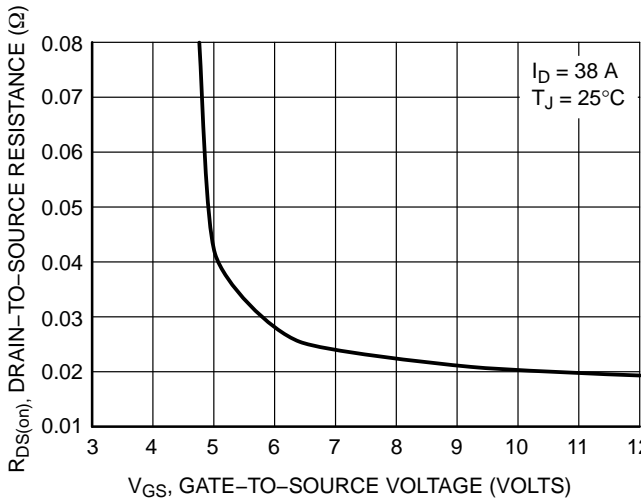


Figure 3. On-Resistance vs. Gate-to-Source Voltage

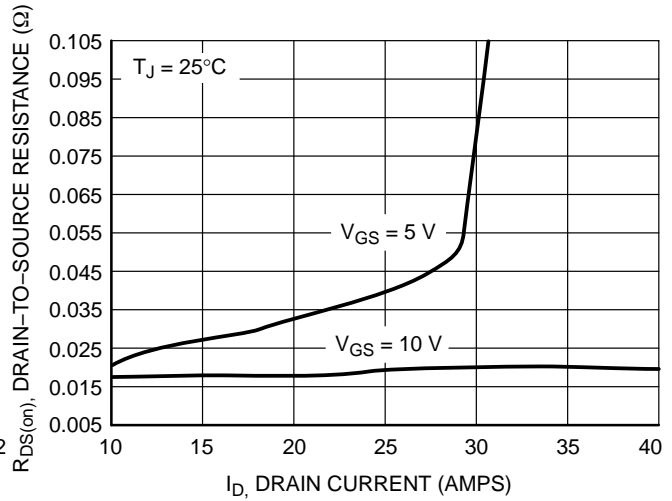


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

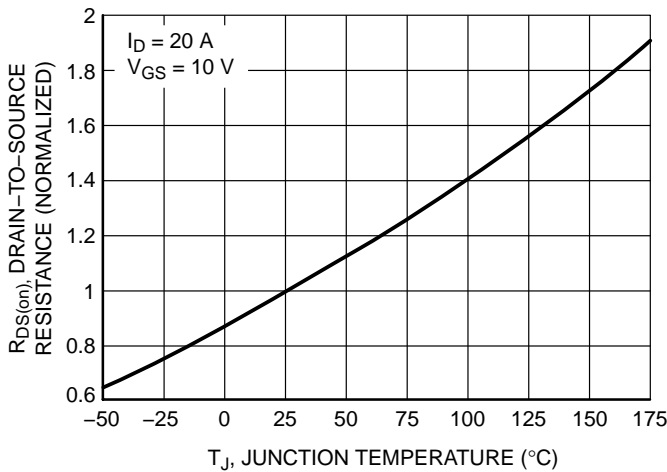


Figure 5. On-Resistance Variation with Temperature

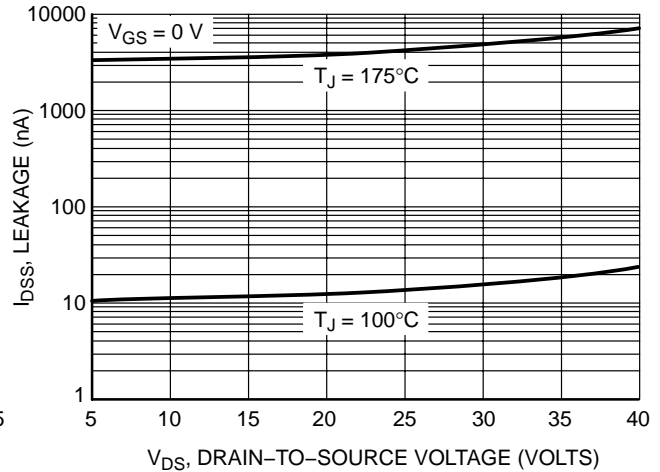


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES

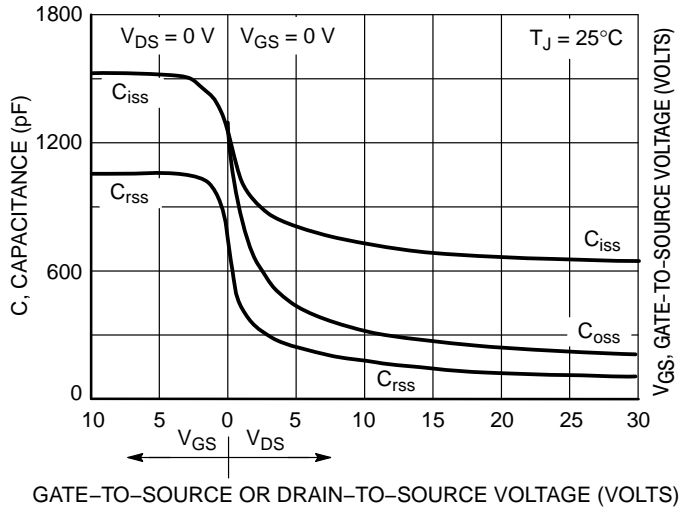


Figure 7. Capacitance Variation

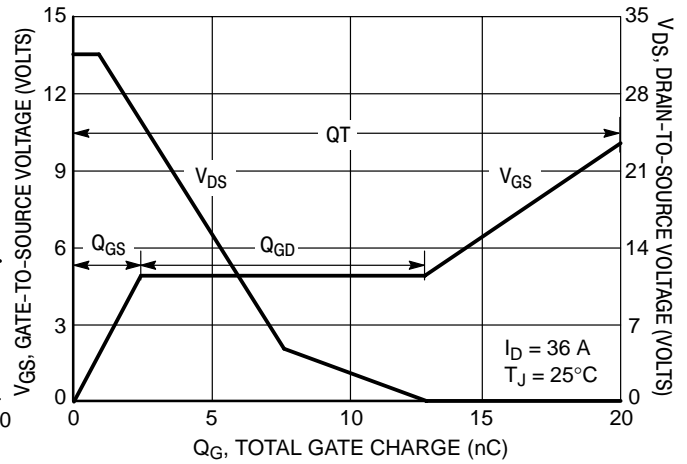


Figure 8. Gate-To-Source and Drain-To-Source Voltage vs. Total Charge

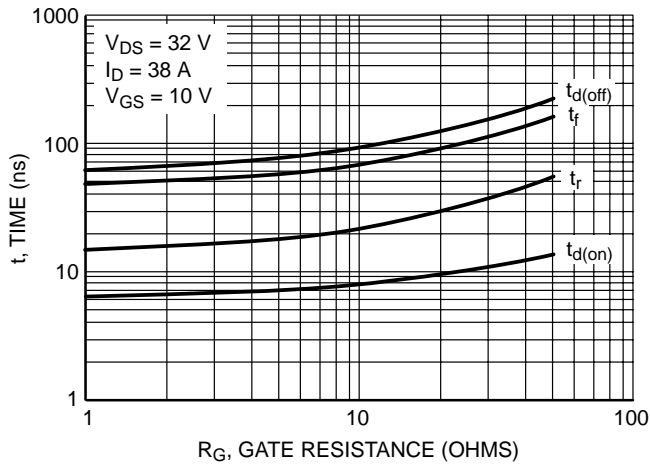


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

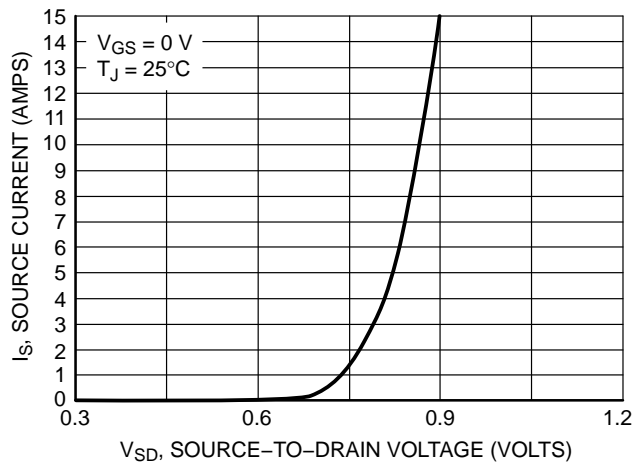
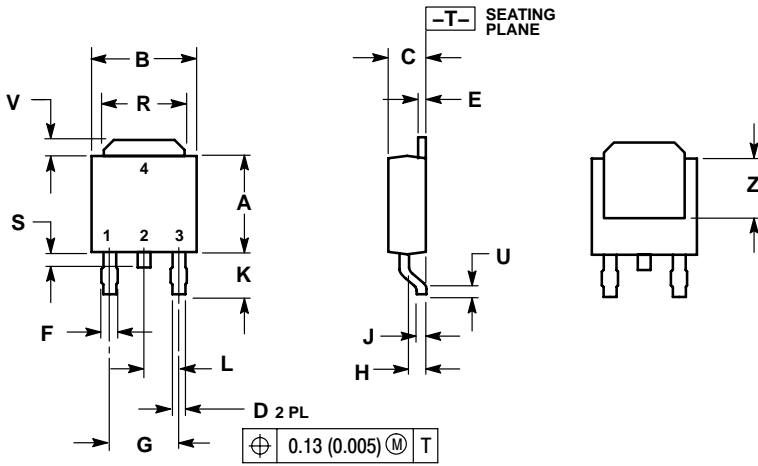


Figure 10. Diode Forward Voltage vs. Current

# NTD5407N

## PACKAGE DIMENSIONS

DPAK  
CASE 369C-01  
ISSUE O

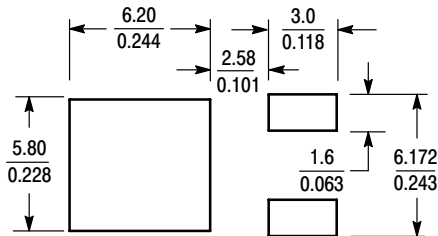


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.235     | 0.245 | 5.97        | 6.22 |
| 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   | 0.180 BSC |       | 4.58 BSC    |      |
| H   | 0.034     | 0.040 | 0.87        | 1.01 |
| J   | 0.018     | 0.023 | 0.46        | 0.58 |
| K   | 0.102     | 0.114 | 2.60        | 2.89 |
| L   | 0.090 BSC |       | 2.29 BSC    |      |
| R   | 0.180     | 0.215 | 4.57        | 5.45 |
| S   | 0.025     | 0.040 | 0.63        | 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\*



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

# NTD5407N

**ON Semiconductor** and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). 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 61312, Phoenix, Arizona 85082-1312 USA  
**Phone:** 480-829-7710 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 480-829-7709 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

**Japan:** ON Semiconductor, Japan Customer Focus Center  
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051  
**Phone:** 81-3-5773-3850

**ON Semiconductor Website:** <http://onsemi.com>

**Order Literature:** <http://www.onsemi.com/litorder>

For additional information, please contact your  
local Sales Representative.

**NTD5407N/D**