

# NTGS3446

## Power MOSFET 20 V, 5.1 A Single N-Channel, TSOP6

### Features

- Ultra Low  $R_{DS(on)}$
- Higher Efficiency Extending Battery Life
- Logic Level Gate Drive
- Diode Exhibits High Speed, Soft Recovery
- Avalanche Energy Specified
- $I_{DSS}$  Specified at Elevated Temperature
- Pb-Free Package is Available

### Applications

- Power Management in portable and battery-powered products, i.e. computers, printers, PCMCIA cards, cellular and cordless
- Lithium Ion Battery Applications
- Notebook PC

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

| Rating                                                                                                        | Symbol                   | Value          | Unit                    |
|---------------------------------------------------------------------------------------------------------------|--------------------------|----------------|-------------------------|
| Drain-to-Source Voltage                                                                                       | $V_{DS}$                 | 20             | V                       |
| Gate-to-Source Voltage                                                                                        | $V_{GS}$                 | $\pm 12$       | V                       |
| Thermal Resistance<br>Junction-to-Ambient (Note 1)<br>Total Power Dissipation @ $T_A = 25^\circ\text{C}$      | $R_{\theta JA}$<br>$P_d$ | 244<br>0.5     | $^\circ\text{C/W}$<br>W |
| Drain Current<br>– Continuous @ $T_A = 25^\circ\text{C}$<br>– Pulsed Drain Current ( $t_p < 10 \mu\text{s}$ ) | $I_D$<br>$I_{DM}$        | 2.5<br>10      | A<br>A                  |
| Thermal Resistance<br>Junction-to-Ambient (Note 2)<br>Total Power Dissipation @ $T_A = 25^\circ\text{C}$      | $R_{\theta JA}$<br>$P_d$ | 128<br>1.0     | $^\circ\text{C/W}$<br>W |
| Drain Current<br>– Continuous @ $T_A = 25^\circ\text{C}$<br>– Pulsed Drain Current ( $t_p < 10 \mu\text{s}$ ) | $I_D$<br>$I_{DM}$        | 3.6<br>14      | A<br>A                  |
| Thermal Resistance<br>Junction-to-Ambient (Note 3)<br>Total Power Dissipation @ $T_A = 25^\circ\text{C}$      | $R_{\theta JA}$<br>$P_d$ | 62.5<br>2.0    | $^\circ\text{C/W}$<br>W |
| Drain Current<br>– Continuous @ $T_A = 25^\circ\text{C}$<br>– Pulsed Drain Current ( $t_p < 10 \mu\text{s}$ ) | $I_D$<br>$I_{DM}$        | 5.1<br>20      | A<br>A                  |
| Source Current (Body Diode)                                                                                   | $I_S$                    | 5.1            | A                       |
| Operating and Storage Temperature Range                                                                       | $T_J, T_{stg}$           | $-55$ to $150$ | $^\circ\text{C}$        |
| Maximum Lead Temperature for Soldering<br>Purposes for 10 seconds                                             | $T_L$                    | 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.

1. Minimum FR-4 or G-10PCB, operating to steady state.
2. Mounted onto a 2" square FR-4 board (1" sq. 2 oz. cu. 0.06" thick single-sided), operating to steady state.
3. Mounted onto a 2" square FR-4 board (1" sq. 2 oz. cu. 0.06" thick single-sided),  $t < 5.0$  seconds.

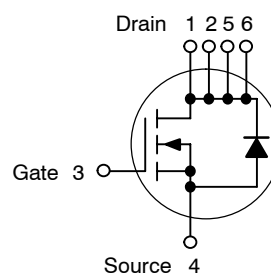


ON Semiconductor®

<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP      | $I_D$ MAX |
|---------------|-----------------------|-----------|
| 20 V          | 36 m $\Omega$ @ 4.5 V | 5.1 A     |

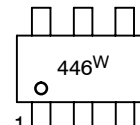
### N-Channel



### MARKING DIAGRAM

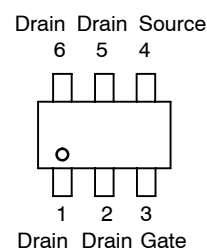


TSOP-6  
CASE 318G  
STYLE 1



446 = Device Code  
W = Work Week

### PIN ASSIGNMENT



### ORDERING INFORMATION

| Device      | Package          | Shipping†        |
|-------------|------------------|------------------|
| NTGS3446T1  | TSOP-6           | 3000/Tape & Reel |
| NTGS3446T1G | TSOP-6 (Pb-Free) | 3000/Tape & Reel |

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

# NTGS3446

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|                                                                                                                                                                          |                                            |         |         |             |              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|---------|---------|-------------|--------------|
| Drain-to-Source Breakdown Voltage<br>(V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 0.25 mAdc)<br>Temperature Coefficient (Positive)                                         | V <sub>(BR)DSS</sub>                       | 20<br>– | –<br>22 | –<br>–      | Vdc<br>mV/°C |
| Zero Gate Voltage Collector Current<br>(V <sub>DS</sub> = 20 Vdc, V <sub>GS</sub> = 0 Vdc)<br>(V <sub>DS</sub> = 20 Vdc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 85°C) | I <sub>DSS</sub>                           | –<br>–  | –<br>–  | 1.0<br>25   | μAdc         |
| Gate-Body Leakage Current (V <sub>GS</sub> = ±12 Vdc, V <sub>DS</sub> = 0)                                                                                               | I <sub>GSS(f)</sub><br>I <sub>GSS(r)</sub> | –<br>–  | –<br>–  | 100<br>–100 | nAdc         |

### ON CHARACTERISTICS (Note 4)

|                                                                                                                                                        |                     |          |              |          |              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------|--------------|----------|--------------|
| Gate Threshold Voltage<br>I <sub>D</sub> = 0.25 mA, V <sub>DS</sub> = V <sub>GS</sub><br>Temperature Coefficient (Negative)                            | V <sub>GS(th)</sub> | 0.6<br>– | 0.85<br>–2.5 | 1.2<br>– | Vdc<br>mV/°C |
| Static Drain-to-Source On-Resistance<br>(V <sub>GS</sub> = 4.5 Vdc, I <sub>D</sub> = 5.1 Adc)<br>(V <sub>GS</sub> = 2.5 Vdc, I <sub>D</sub> = 4.4 Adc) | R <sub>DS(on)</sub> | –<br>–   | 36<br>44     | 45<br>55 | mΩ           |
| Forward Transconductance (V <sub>DS</sub> = 10 Vdc, I <sub>D</sub> = 5.1 Adc)                                                                          | g <sub>FS</sub>     | –        | 12           | –        | mhos         |

### DYNAMIC CHARACTERISTICS

|                      |                                                                     |                  |   |     |     |    |
|----------------------|---------------------------------------------------------------------|------------------|---|-----|-----|----|
| Input Capacitance    | (V <sub>DS</sub> = 10 Vdc, V <sub>GS</sub> = 0 Vdc,<br>f = 1.0 MHz) | C <sub>iss</sub> | – | 510 | 750 | pF |
| Output Capacitance   |                                                                     | C <sub>oss</sub> | – | 200 | 350 |    |
| Transfer Capacitance |                                                                     | C <sub>rss</sub> | – | 60  | 100 |    |

### SWITCHING CHARACTERISTICS (Note 5)

|                     |                                                                                                            |                     |   |     |    |    |
|---------------------|------------------------------------------------------------------------------------------------------------|---------------------|---|-----|----|----|
| Turn-On Delay Time  | (V <sub>DD</sub> = 10 Vdc, I <sub>D</sub> = 1.0 Adc,<br>V <sub>GS</sub> = 4.5 Vdc, R <sub>G</sub> = 6.0 Ω) | t <sub>d(on)</sub>  | – | 9.0 | 16 | ns |
| Rise Time           |                                                                                                            | t <sub>r</sub>      | – | 12  | 20 |    |
| Turn-Off Delay Time |                                                                                                            | t <sub>d(off)</sub> | – | 35  | 60 |    |
| Fall Time           |                                                                                                            | t <sub>f</sub>      | – | 20  | 35 |    |
| Gate Charge         | (V <sub>DS</sub> = 10 Vdc, I <sub>D</sub> = 5.1 Adc,<br>V <sub>GS</sub> = 4.5 Vdc)                         | Q <sub>T</sub>      | – | 8.0 | 15 | nC |
|                     |                                                                                                            | Q <sub>gs</sub>     | – | 2.0 | –  |    |
|                     |                                                                                                            | Q <sub>gd</sub>     | – | 2.0 | –  |    |

### SOURCE-DRAIN DIODE CHARACTERISTICS

|                                |                                                                                                                                   |                 |        |              |          |     |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------|--------|--------------|----------|-----|
| Forward On-Voltage (Note 4)    | (I <sub>S</sub> = 1.7 Adc, V <sub>GS</sub> = 0 Vdc)<br>(I <sub>S</sub> = 1.7 Adc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 85°C) | V <sub>SD</sub> | –<br>– | 0.74<br>0.66 | 1.1<br>– | Vdc |
| Reverse Recovery Time          | (I <sub>S</sub> = 1.7 Adc, V <sub>GS</sub> = 0 Vdc,<br>dis/dt = 100 A/μs)                                                         | t <sub>rr</sub> | –      | 20           | –        | ns  |
|                                |                                                                                                                                   | t <sub>a</sub>  | –      | 11           | –        |     |
|                                |                                                                                                                                   | t <sub>b</sub>  | –      | 9.0          | –        |     |
| Reverse Recovery Stored Charge |                                                                                                                                   | Q <sub>RR</sub> | –      | 0.01         | –        | μC  |

4. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.  
5. Switching characteristics are independent of operating junction temperature.

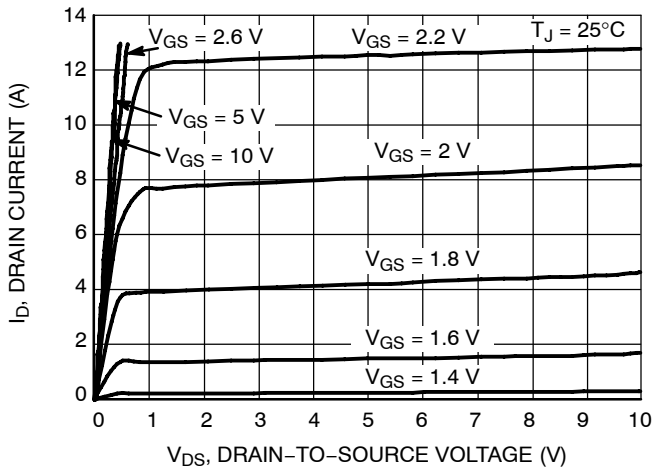


Figure 1. On-Region Characteristics

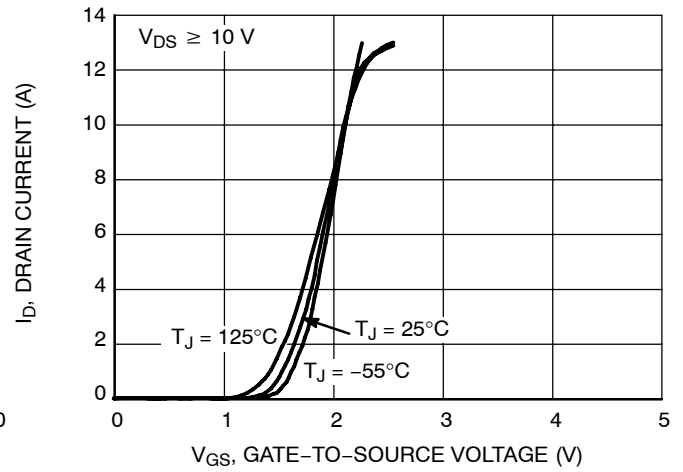


Figure 2. Transfer Characteristics

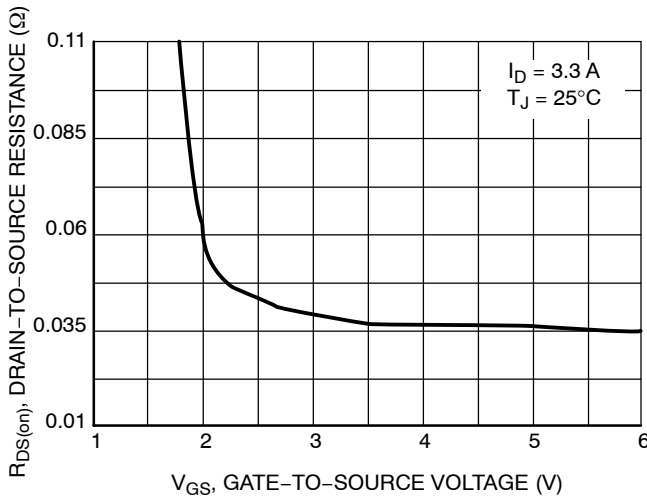


Figure 3. On-Resistance versus Gate-to-Source Voltage

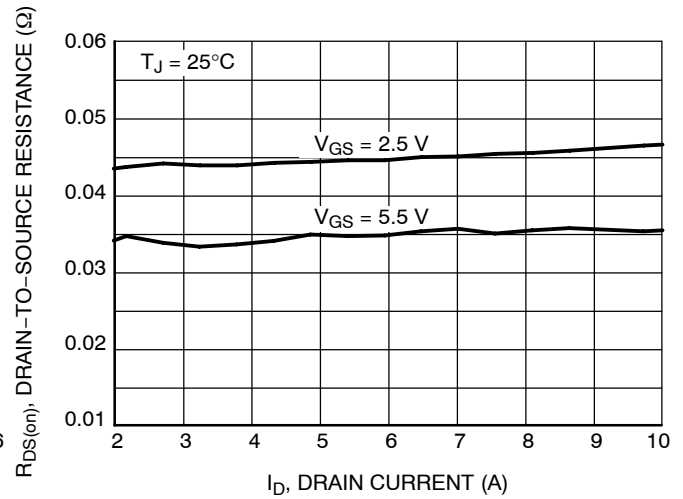


Figure 4. On-Resistance versus Drain Current and Gate Voltage

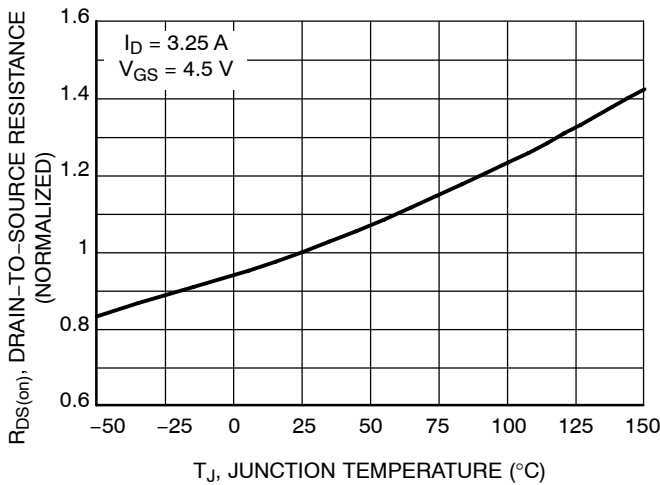


Figure 5. On-Resistance Variation with Temperature

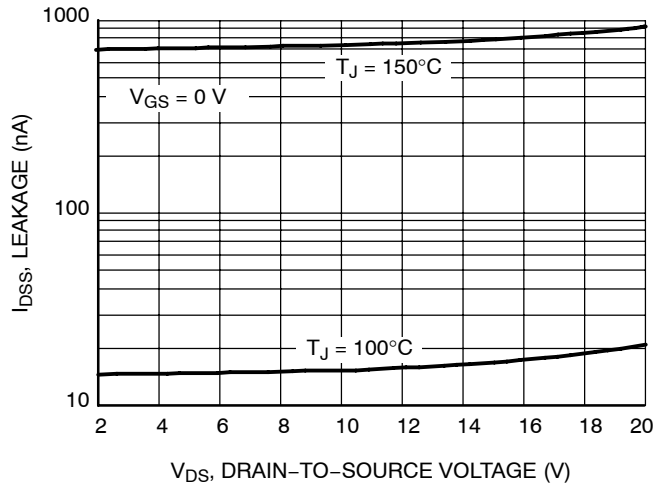
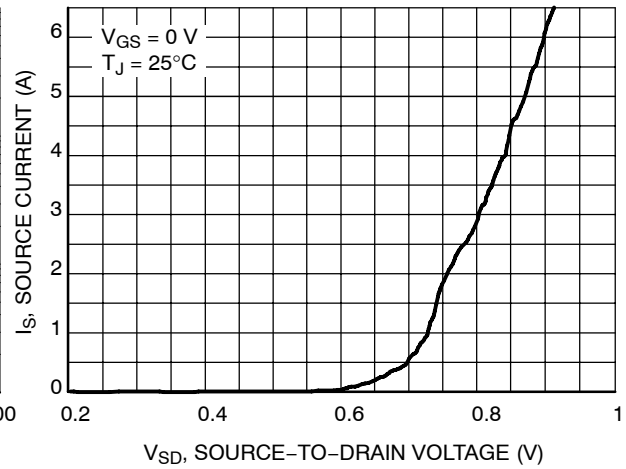
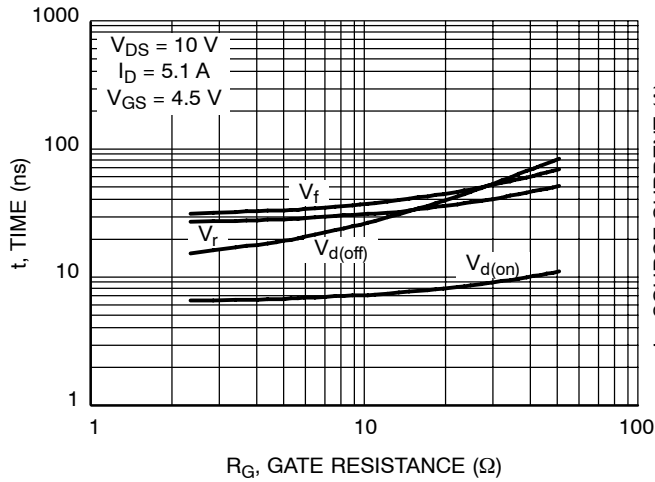
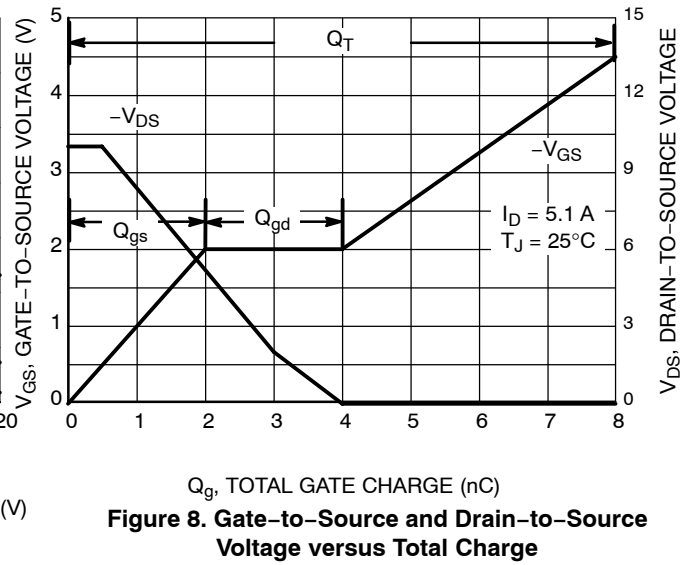
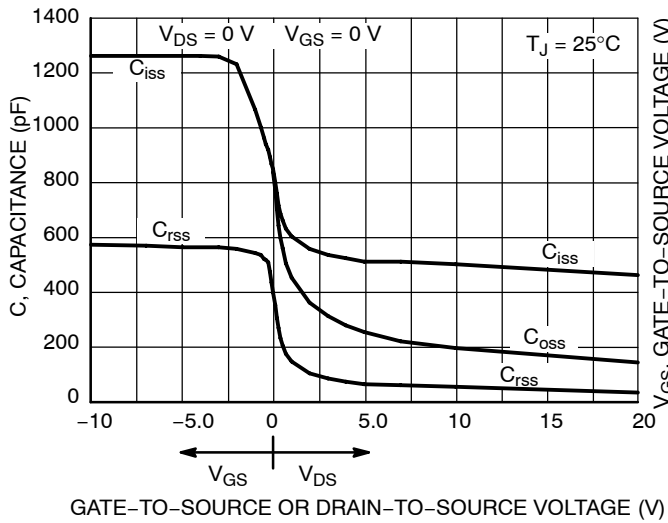


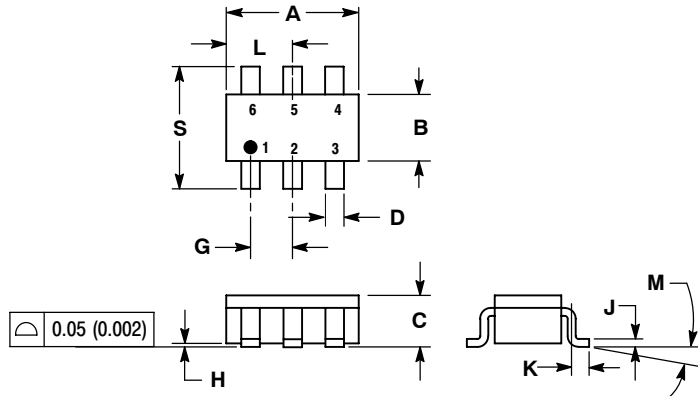
Figure 6. Drain-to-Source Leakage Current versus Voltage



# NTGS3446

## PACKAGE DIMENSIONS

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



#### NOTES:

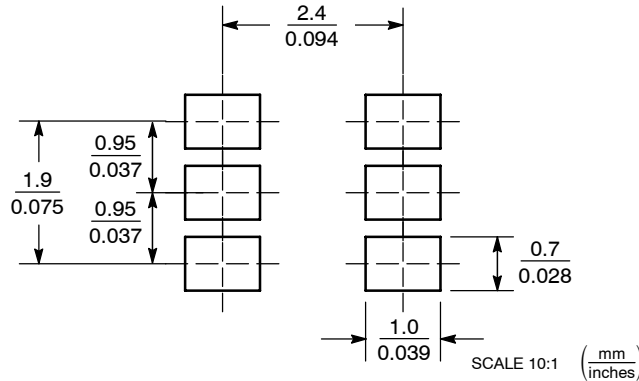
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | MILLIMETERS |       | INCHES |        |
|-----|-------------|-------|--------|--------|
|     | MIN         | MAX   | MIN    | MAX    |
| A   | 2.90        | 3.10  | 0.1142 | 0.1220 |
| B   | 1.30        | 1.70  | 0.0512 | 0.0669 |
| C   | 0.90        | 1.10  | 0.0354 | 0.0433 |
| D   | 0.25        | 0.50  | 0.0098 | 0.0197 |
| E   | 0.85        | 1.05  | 0.0335 | 0.0413 |
| F   | 0.013       | 0.100 | 0.0005 | 0.0040 |
| G   | 0.10        | 0.26  | 0.0040 | 0.0102 |
| H   | 0.20        | 0.60  | 0.0079 | 0.0236 |
| I   | 1.25        | 1.55  | 0.0493 | 0.0610 |
| J   | 0°          | 10°   | 0°     | 10°    |
| K   | 2.50        | 3.00  | 0.0985 | 0.1181 |

#### STYLE 1:

1. DRAIN
2. DRAIN
3. GATE
4. SOURCE
5. DRAIN
6. 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.

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.



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.