

# NTGS5120P, NVGS5120P

## Power MOSFET

-60 V, -2.9 A, Single P-Channel, TSOP-6

### Features

- 60 V BVds, Low R<sub>DS(on)</sub> in TSOP-6 Package
- 4.5 V Gate Rating
- NV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- This is a Pb-Free Device

### Applications

- High Side Load Switch
- Power Switch for Printers, Communication Equipment

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

Parameter		Symbol	Value	Unit	
Drain-to-Source Voltage		V <sub>DSS</sub>	-60	V	
Gate-to-Source Voltage		V <sub>GS</sub>	±20	V	
Continuous Drain Current (Note 1)	Steady State	T <sub>A</sub> = 25°C	I <sub>D</sub>	-2.5	A
		T <sub>A</sub> = 85°C		-2.0	
	t ≤ 5 s	T <sub>A</sub> = 25°C		-2.9	
Power Dissipation (Note 1)	Steady State	T <sub>A</sub> = 25°C	P <sub>D</sub>	1.1	W
	t ≤ 5 s			1.4	
Continuous Drain Current (Note 2)	Steady State	T <sub>A</sub> = 25°C	I <sub>D</sub>	-1.8	A
		T <sub>A</sub> = 85°C		-1.3	
Power Dissipation (Note 2)		T <sub>A</sub> = 25°C	P <sub>D</sub>	0.6	W
Pulsed Drain Current	t <sub>p</sub> = 10 μs	I <sub>DM</sub>	-20	A	
Operating Junction and Storage Temperature		T <sub>J</sub> , T <sub>STG</sub>	-55 to 150	°C	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		T <sub>L</sub>	260	°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.

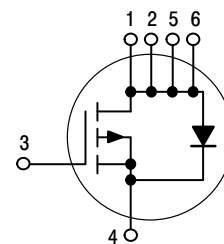


ON Semiconductor®

<http://onsemi.com>

V <sub>(BR)DSS</sub>	R <sub>DS(ON)</sub> MAX	I <sub>D</sub> MAX
-60 V	111 mΩ @ -10 V	-2.9 A
	142 mΩ @ -4.5 V	

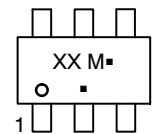
### P-Channel



### MARKING DIAGRAM

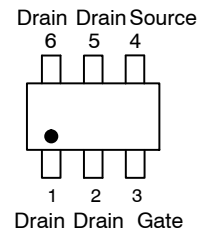


TSOP-6  
CASE 318G  
STYLE 1



XX = 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 on page 5 of this data sheet.

# NTGS5120P, NVGS5120P

## THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Ambient – Steady State (Note 3)	$R_{\theta JA}$	102	°C/W
Junction-to-Ambient – $t = 5$ s (Note 3)	$R_{\theta JA}$	77.6	
Junction-to-Ambient – Steady State (Note 4)	$R_{\theta JA}$	200	

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.

## 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, $I_D = -250$ $\mu\text{A}$	-60			V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0$ V, $V_{DS} = -48$ V	$T_J = 25^\circ\text{C}$		-1.0	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		-5.0	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0$ V, $V_{GS} = \pm 12$ V			$\pm 100$	nA
		$V_{DS} = 0$ V, $V_{GS} = \pm 20$ V			$\pm 200$	nA

### ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}$ , $I_D = -250$ $\mu\text{A}$	-1.0		-3.0	V
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = -10$ V, $I_D = -2.9$ A		72	111	m $\Omega$
		$V_{GS} = -4.5$ V, $I_D = -2.5$ A		88	142	
Forward Transconductance	$g_{FS}$	$V_{DS} = -5.0$ V, $I_D = -6.0$ A		10.1		S

### CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0$ V, $f = 1$ MHz, $V_{DS} = -30$ V		942		pF
Output Capacitance	$C_{OSS}$			72		
Reverse Transfer Capacitance	$C_{RSS}$			48		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -10$ V, $V_{DS} = -30$ V; $I_D = -2.9$ A		18.1		nC
Threshold Gate Charge	$Q_{G(TH)}$			1.2		
Gate-to-Source Charge	$Q_{GS}$			2.7		
Gate-to-Drain Charge	$Q_{GD}$			3.6		

### SWITCHING CHARACTERISTICS (Note 6)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -10$ V, $V_{DS} = -30$ V, $I_D = -1.0$ A, $R_G = 6.0$ $\Omega$		8.7		ns
Rise Time	$t_r$			4.9		
Turn-Off Delay Time	$t_{d(OFF)}$			38		
Fall Time	$t_f$			12.8		

### DRAIN-SOURCE DIODE CHARACTERISTICS

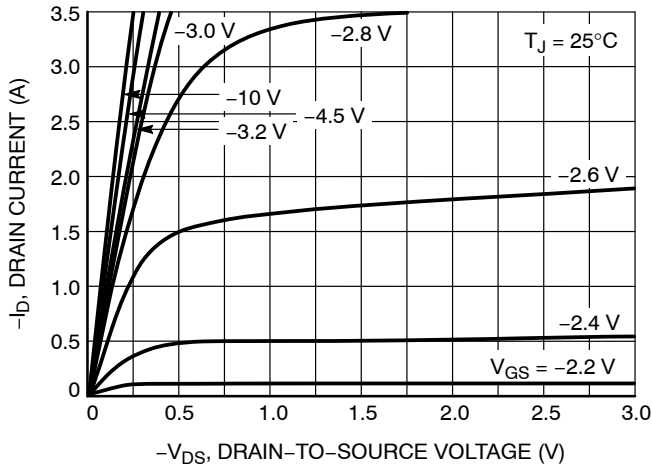
Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0$ V, $I_S = -0.9$ A	$T_J = 25^\circ\text{C}$		-0.75	-1.0	V
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0$ V, $dI_S/dt = 100$ A/ $\mu\text{s}$ , $I_S = -0.9$ A			18.3		ns
Charge Time	$t_a$				15.5		ns
Reverse Recovery Charge	$Q_{RR}$				15.1		nC

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.

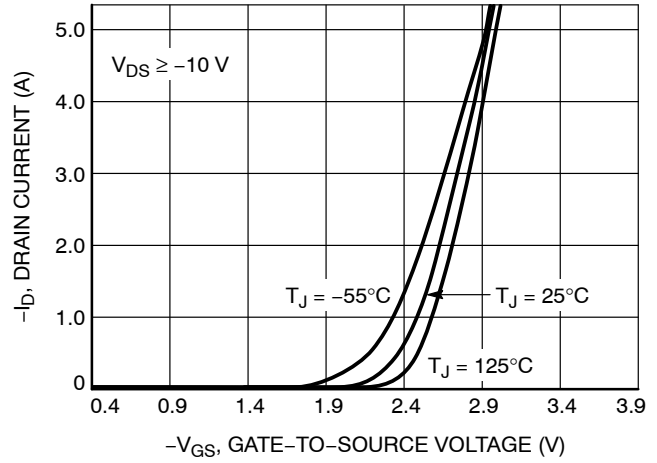
5. Pulse Test: pulse width  $\leq 300$   $\mu\text{s}$ , duty cycle  $\leq 2\%$   
 6. Switching characteristics are independent of operating junction temperatures

# NTGS5120P, NVGS5120P

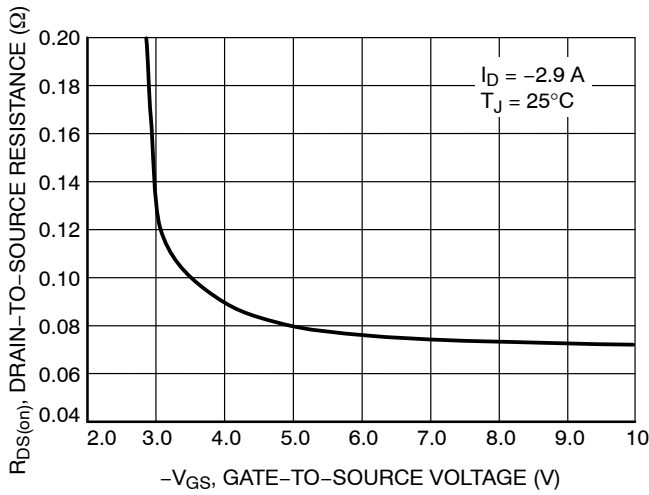
## TYPICAL CHARACTERISTICS



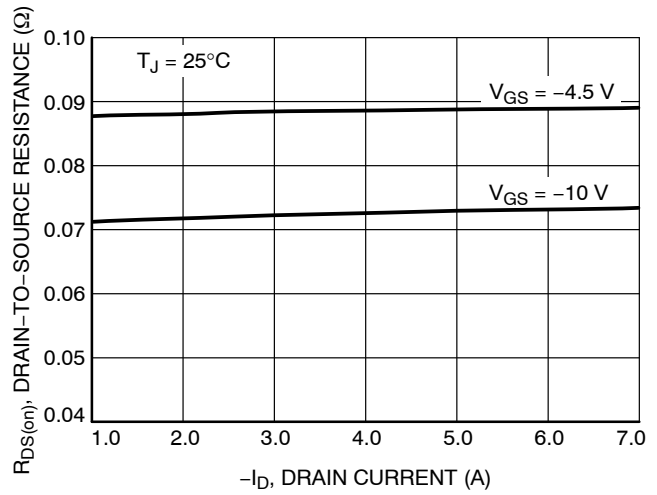
**Figure 1. On-Region Characteristics**



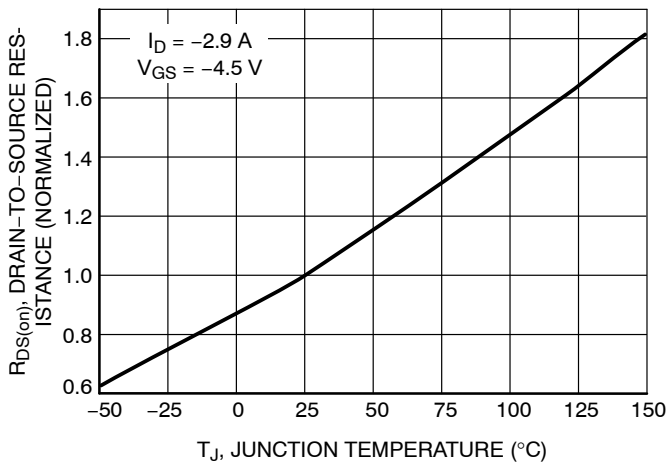
**Figure 2. Transfer Characteristics**



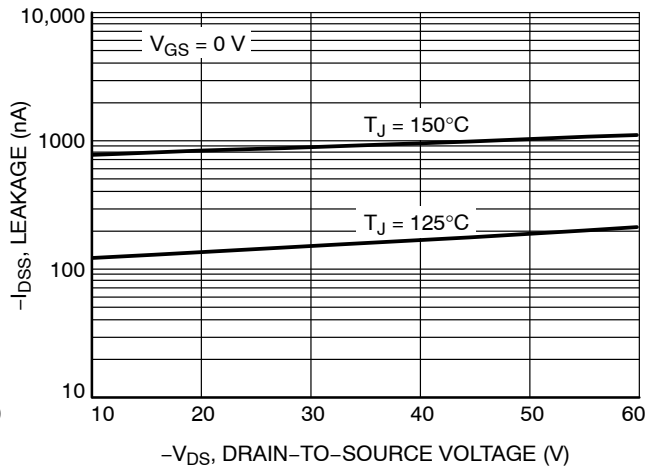
**Figure 3. On-Resistance vs. Gate Voltage**



**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**

# NTGS5120P, NVGS5120P

## TYPICAL CHARACTERISTICS

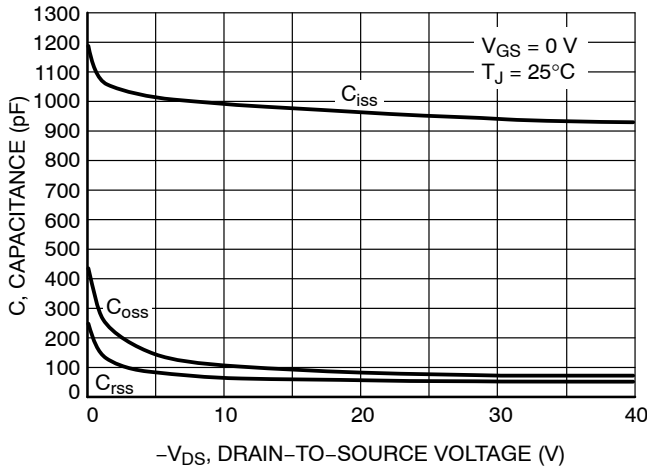


Figure 7. Capacitance Variation

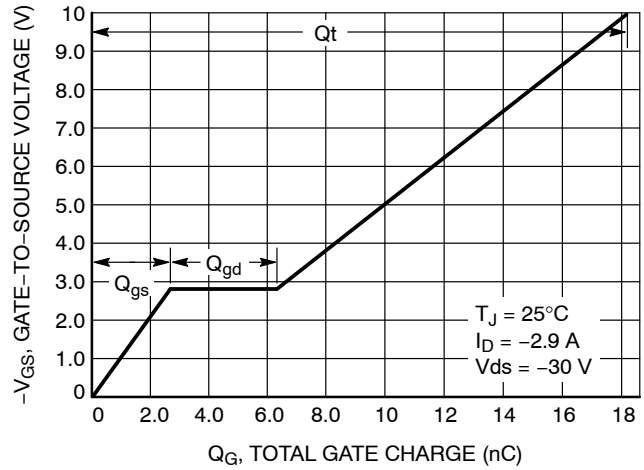


Figure 8. Gate-to-Source Voltage vs. Total Charge

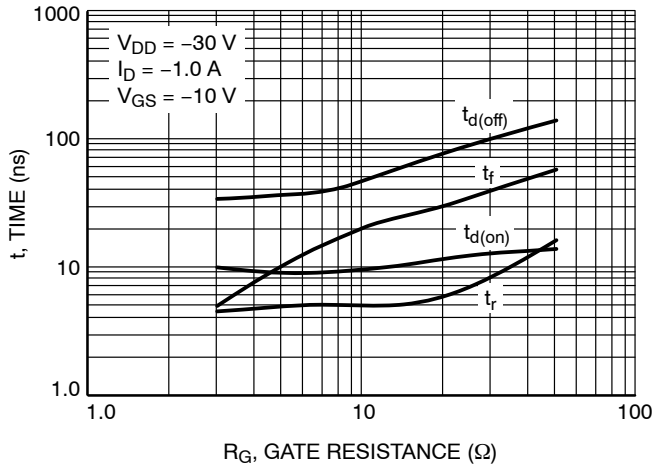


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

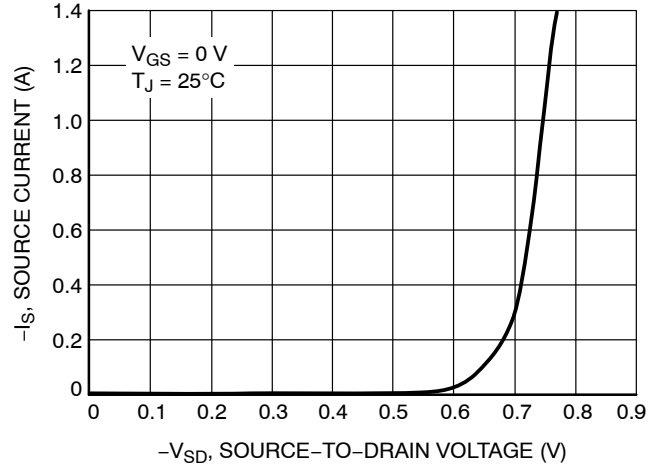


Figure 10. Diode Forward Voltage vs. Current

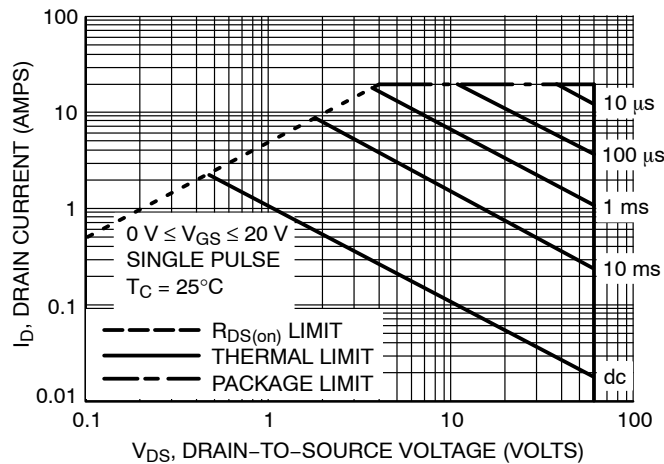


Figure 11. Maximum Rated Forward Biased Safe Operating Area

# NTGS5120P, NVGS5120P

## TYPICAL CHARACTERISTICS

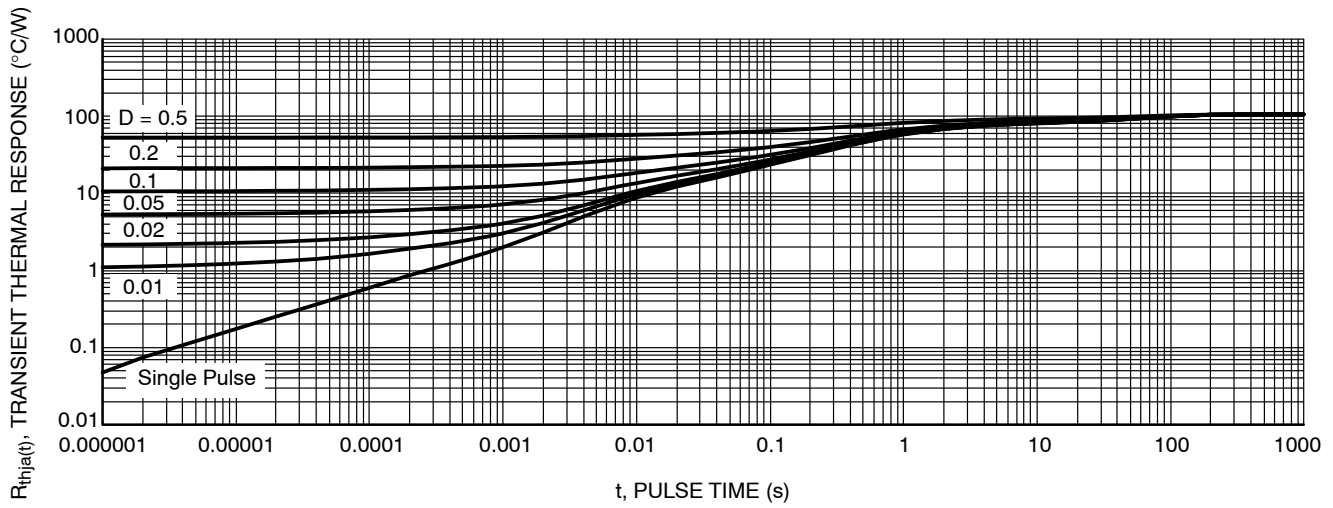


Figure 12. Thermal Response

Table 1. ORDERING INFORMATION

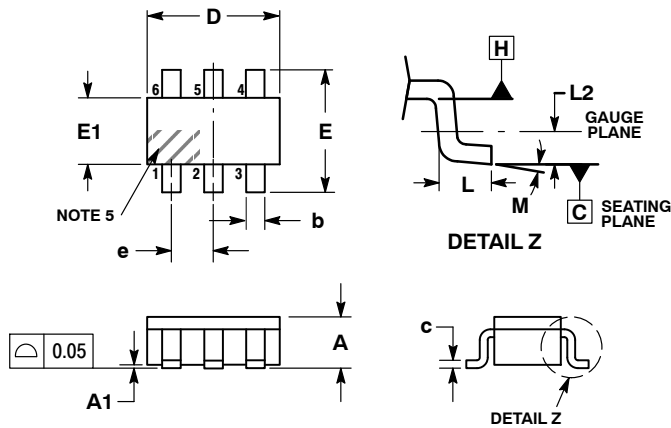
Part Number	Marking (XX)	Package	Shipping <sup>†</sup>
NTGS5120PT1G	P6	TSOP-6 (Pb-Free)	3000 / Tape & Reel
NVGS5120PT1G	VP6	TSOP-6 (Pb-Free)	3000 / Tape & Reel

<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.

# NTGS5120P, NVGS5120P

## PACKAGE DIMENSIONS

TSOP-6  
CASE 318G-02  
ISSUE V



NOTES:

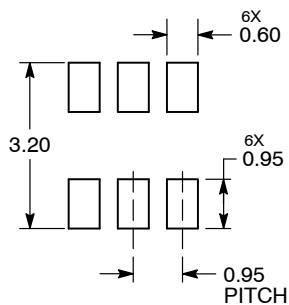
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, 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:

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-Marketing.pdf](http://www.onsemi.com/site/pdf/Patent-Marketing.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

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[ON Semiconductor:](#)

[NTGS5120PT1G](#) [NVGS5120PT1G](#)