

# NTP5864N

## Power MOSFET

60 V, 63 A, 12.4 mΩ

### Features

- Low  $R_{DS(on)}$
- High Current Capability
- Avalanche Energy Specified
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

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

Parameter		Symbol	Value	Units
Drain-to-Source Voltage		$V_{DS}$	60	V
Gate-to-Source Voltage – Continuous		$V_{GS}$	$\pm 20$	V
Gate-to-Source Voltage – Non-Repetitive ( $t_p = 10 \mu\text{s}$ )		$V_{GS}$	$\pm 30$	V
Continuous Drain Current – $R_{\theta JC}$ (Note 1)	Steady State	$T_C = 25^\circ\text{C}$	63	A
		$T_C = 100^\circ\text{C}$	45	
Power Dissipation – $R_{\theta JC}$ (Note 1)	Steady State	$T_C = 25^\circ\text{C}$	107	W
		$T_C = 100^\circ\text{C}$	54	
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	$I_{DM}$	252	A
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-55 to 175	$^\circ\text{C}$
Source Current (Body Diode) Pulsed		$I_S$	63	A
Single Pulse Drain-to-Source Avalanche Energy – ( $L = 0.1 \text{ mH}$ )		EAS	80	mJ
		IAS	40	A
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.

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Units
Junction-to-Case (Drain) – Steady State (Note 1)	$R_{\theta JC}$	1.4	$^\circ\text{C/W}$
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	33	$^\circ\text{C/W}$

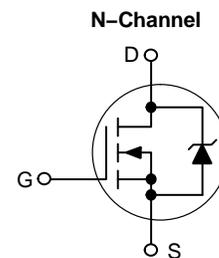
1. Surface mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).



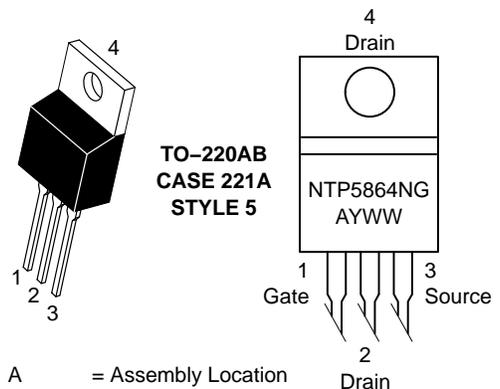
ON Semiconductor®

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

$V_{(BR)DSS}$	$R_{DS(ON) MAX}$	$I_D MAX$ (Note 1)
60 V	12.4 mΩ @ 10 V	63 A



### MARKING DIAGRAM & PIN ASSIGNMENT



- A = Assembly Location
- Y = Year
- WW = Work Week
- G = Pb-Free Package

### ORDERING INFORMATION

Device	Package	Shipping
NTP5864NG	TO-220 (Pb-Free)	50 Units / Rail

# NTP5864N

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

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

### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>			58		mV/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 60 V			1.0	μA
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 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	2.0		4.0	V
Gate Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>			-10		mV/°C
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A		10.2	12.4	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 20 A		10		S

### CHARGES AND CAPACITANCES

Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = 25 V		1680		pF
Output Capacitance	C <sub>OSS</sub>			189		
Reverse Transfer Capacitance	C <sub>RSS</sub>			124		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 48 V, I <sub>D</sub> = 20 A		31		nC
Threshold Gate Charge	Q <sub>G(TH)</sub>			2.0		
Gate-to-Source Charge	Q <sub>GS</sub>			7.3		
Gate-to-Drain Charge	Q <sub>GD</sub>			10		
Gate Resistance	R <sub>g</sub>			0.5		Ω

### 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> = 48 V, I <sub>D</sub> = 20 A, R <sub>G</sub> = 2.5 Ω		10		ns
Rise Time	t <sub>r</sub>			6.4		
Turn-Off Delay Time	t <sub>d(OFF)</sub>			18		
Fall Time	t <sub>f</sub>			4.6		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 40 A	T <sub>J</sub> = 25°C	0.94	1.2	V
			T <sub>J</sub> = 125°C	0.84		
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, dI <sub>SD</sub> /dt = 100 A/μs, I <sub>S</sub> = 20 A		24		ns
Charge Time	t <sub>a</sub>			16		
Discharge Time	t <sub>b</sub>			7.9		
Reverse Recovery Charge	Q <sub>RR</sub>			20		

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

TYPICAL CHARACTERISTICS

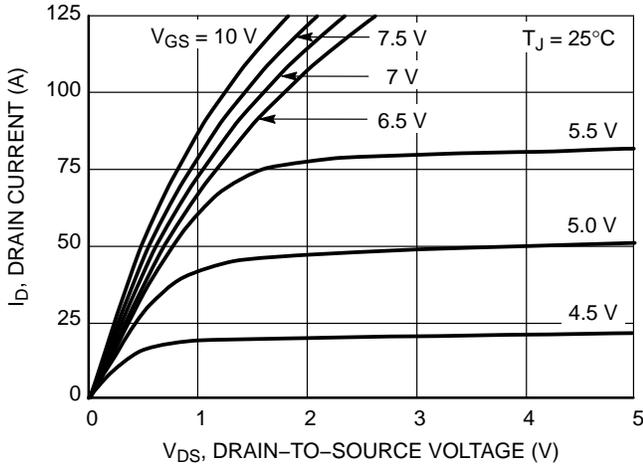


Figure 1. On-Region Characteristics

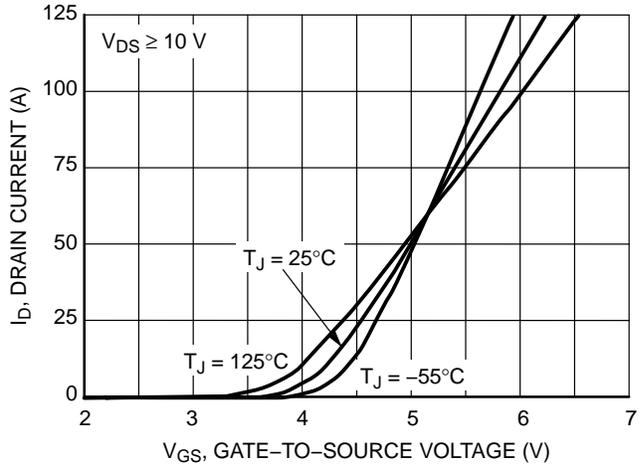


Figure 2. Transfer Characteristics

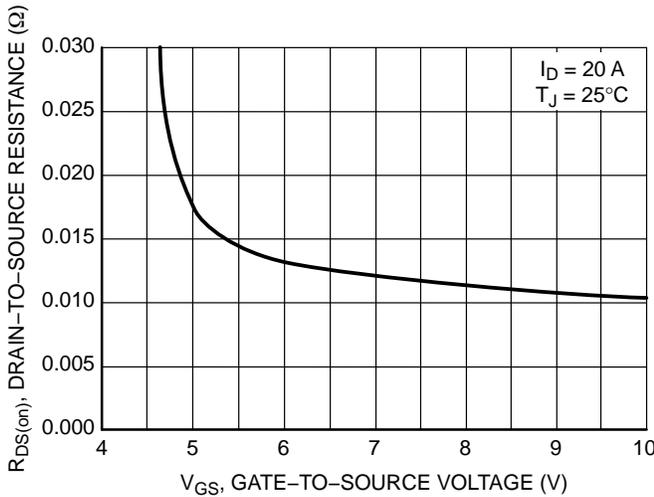


Figure 3. On-Resistance vs. Gate Voltage

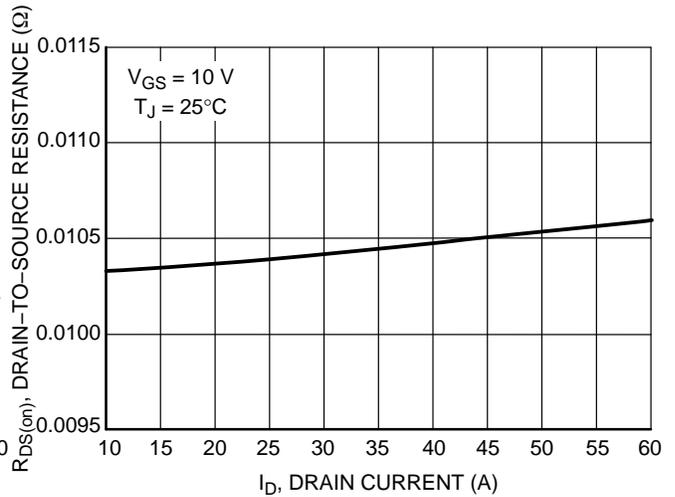


Figure 4. On-Resistance vs. Drain Current

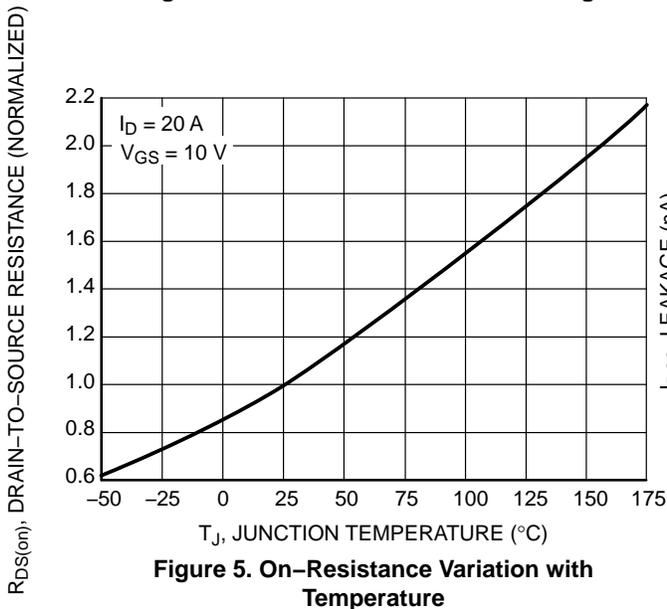


Figure 5. On-Resistance Variation with Temperature

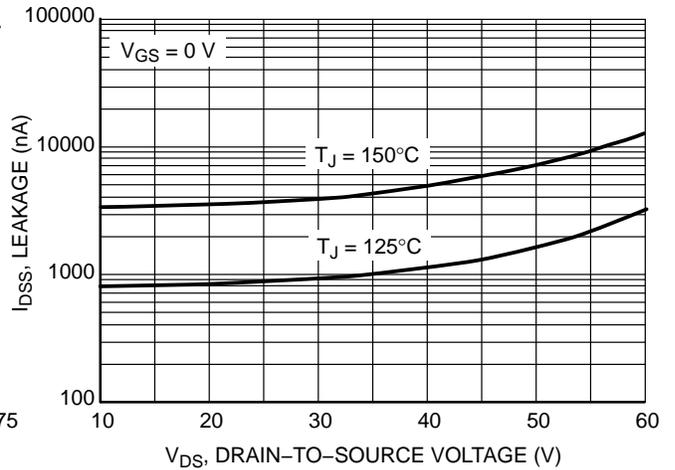


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTP5864N

## TYPICAL CHARACTERISTICS

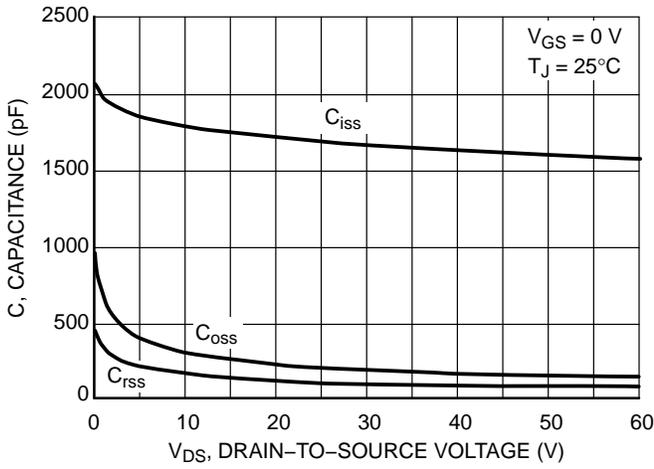


Figure 7. Capacitance Variation

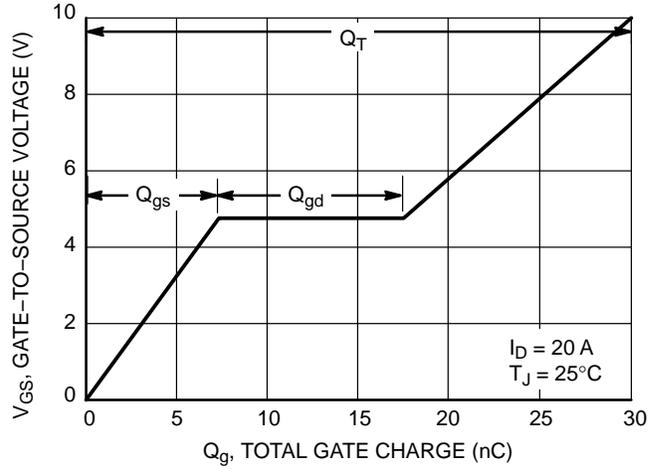


Figure 8. Gate-to-Source vs. Total Charge

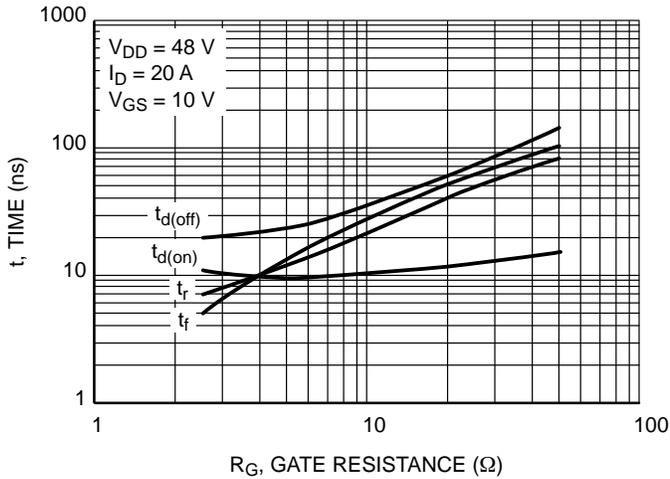


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

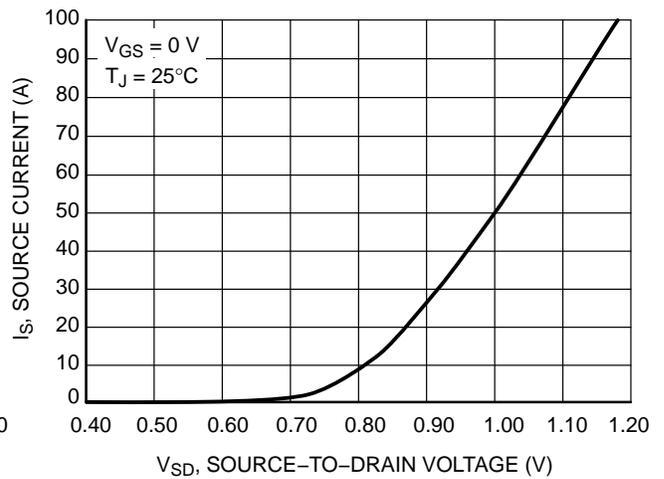


Figure 10. Diode Forward Voltage vs. Current

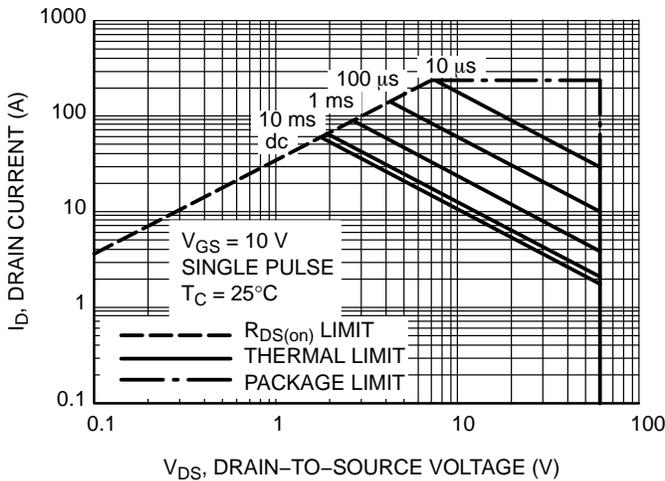


Figure 11. Maximum Rated Forward Biased Safe Operating Area

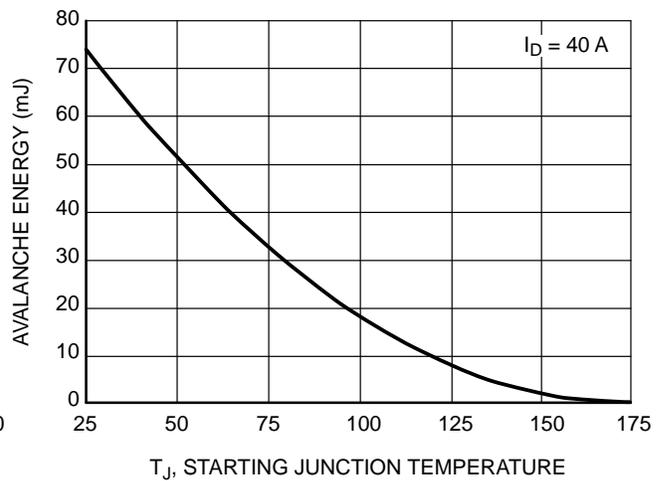


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

# NTP5864N

## TYPICAL CHARACTERISTICS

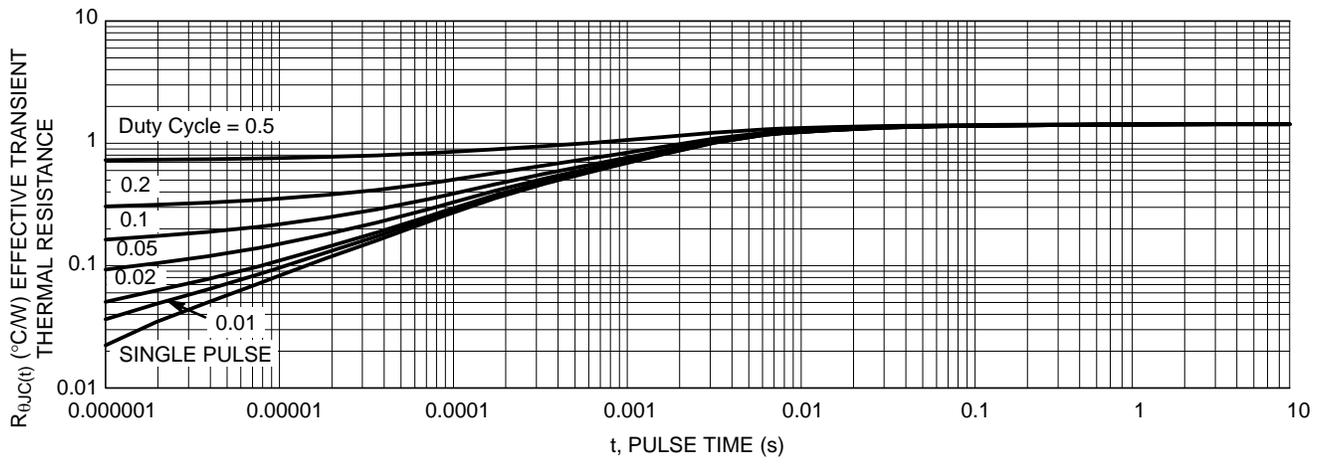
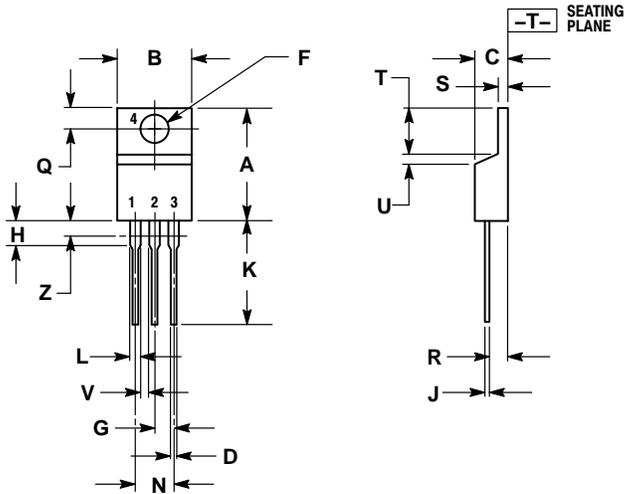


Figure 13. Thermal Response

# NTP5864N

## PACKAGE DIMENSIONS

TO-220  
CASE 221A-09  
ISSUE AH



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.415	9.66	10.53
C	0.160	0.190	4.07	4.83
D	0.025	0.038	0.64	0.96
F	0.142	0.161	3.61	4.09
G	0.095	0.105	2.42	2.66
H	0.110	0.161	2.80	4.10
J	0.014	0.024	0.36	0.61
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

STYLE 5:

- PIN 1. GATE
- DRAIN
- SOURCE
- DRAIN

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