

# NTP5N60

Preferred Devices

## Product Preview

# Power MOSFET

## 5 Amps, 600 Volts

### N-Channel TO-220

Designed for high voltage, high speed switching applications in power supplies, converters, power motor controls and bridge circuits.

#### Features

- Higher Current Rating
- Lower  $R_{DS(on)}$
- Lower Capacitances
- Lower Total Gate Charge
- Tighter  $V_{SD}$  Specifications
- Avalanche Energy Specified

#### Typical Applications

- Switch Mode Power Supplies
- PWM Motor Controls
- Converters
- Bridge Circuits

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

Rating	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	600	Vdc
Drain-Gate Voltage ( $R_{GS} = 1.0\text{ M}\Omega$ )	$V_{DGR}$	600	Vdc
Gate-Source Voltage	$V_{GS}$	$\pm 20$	Vdc
- Continuous	$V_{GS}$	$\pm 40$	
- Non-Repetitive ( $t_p \leq 10\text{ ms}$ )			
Drain-Continuous @ $T_A 25^\circ\text{C}$	$I_D$	5	Adc
- Continuous @ $T_A 100^\circ\text{C}$	$I_D$	3.8	
- Single Pulse ( $t_p \leq 10\text{ }\mu\text{s}$ )	$I_{DM}$	17.5	Apk
Total Power Dissipation @ $T_A 25^\circ\text{C}$	$P_D$	96	Watts
Derate above $25^\circ\text{C}$		0.77	W/ $^\circ\text{C}$
Total Power Dissipation @ $T_A 25^\circ\text{C}$ (Note 1.)		1.75	Watts
Operating and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$
Single Drain-to-Source Avalanche Energy - Starting $T_J = 25^\circ\text{C}$ ( $V_{DD} = 100\text{ V}$ , $V_{GS} = 10\text{ Vdc}$ , $I_L(pk) = 5\text{ A}$ , $L = 10\text{ mH}$ , $V_{DS} = 600\text{ Vdc}$ , $R_G = 25\text{ }\Omega$ )	$E_{AS}$	80	mJ
Thermal Resistance			$^\circ\text{C/W}$
- Junction-to-Case	$R_{\theta JC}$	1.3	
- Junction-to-Ambient	$R_{\theta JA}$	62.5	
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	$T_L$	260	$^\circ\text{C}$

1. Repetitive rating; pulse width limited by maximum junction temperature.

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

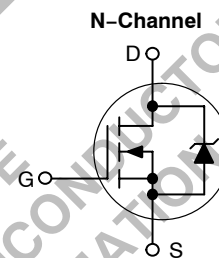


ON Semiconductor™

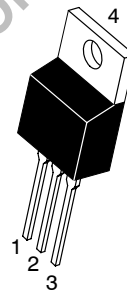
<http://onsemi.com>

**5 AMPERES**  
**600 VOLTS**

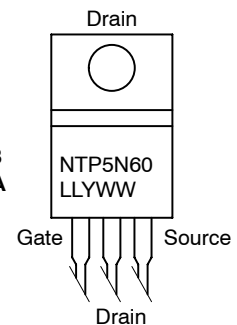
$R_{DS(on)} = 2400\text{ m}\Omega$



#### MARKING DIAGRAMS AND PIN ASSIGNMENTS



TO-220AB  
CASE 221A  
STYLE 5



NTP5N60 = Device Code  
LL = Location Code  
Y = Year  
WW = Work Week

#### ORDERING INFORMATION

Device	Package	Shipping
NTP5N60	TO-220AB	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

# NTP5N60

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Drain-to-Source Breakdown Voltage (Note 1) (V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 250 μAdc) Temperature Coefficient (Positive)	V <sub>(BR)DSS</sub>	600	-	-	Vdc
		-	700	-	mV/°C
Zero Gate Voltage Drain Current (V <sub>DS</sub> = 600 Vdc, V <sub>GS</sub> = 0 Vdc) (V <sub>DS</sub> = 600 Vdc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	I <sub>DSS</sub>	-	-	10	μAdc
		-	-	100	
Gate-Body Leakage Current (V <sub>GS</sub> = ±20 Vdc, V <sub>DS</sub> = 0 Vdc)	I <sub>GSS</sub>	-	-	±100	nAdc

## ON CHARACTERISTICS (Note 1)

Gate Threshold Voltage (V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μAdc) Temperature Coefficient (Negative)	V <sub>GS(th)</sub>	2.0	2.7	4.0	Vdc
		-	6.0	-	mV/°C
Static Drain-to-Source On-Resistance (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 2.5 Adc)	R <sub>DS(on)</sub>	-	2100	2400	mOhm
Static Drain-to-Source On-Resistance (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 5 Adc) (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 2.5 Adc, T <sub>J</sub> = 125°C)	V <sub>DS(on)</sub>	-	-	14.4	V
		-	-	13.1	
Forward Transconductance (V <sub>DS</sub> = 15 Vdc, I <sub>D</sub> = 2.5 Adc)	g <sub>FS</sub>	0.7	3.8	-	mhos

## DYNAMIC CHARACTERISTICS

Input Capacitance	(V <sub>DS</sub> = 25 Vdc, V <sub>GS</sub> = 0 Vdc, f = 1.0 MHz)	C <sub>iss</sub>	-	540	780	pF
Output Capacitance		C <sub>oss</sub>	-	125	180	
Transfer Capacitance		C <sub>rss</sub>	-	8.0	20	

## SWITCHING CHARACTERISTICS (Note 2)

Turn-On Delay Time	(V <sub>DD</sub> = 300 Vdc, I <sub>D</sub> = 5 Adc, V <sub>GS</sub> = 10 Vdc, R <sub>G</sub> = 9.1 Ω)	t <sub>d(on)</sub>	-	12	20	ns
Rise Time		t <sub>r</sub>	-	7.0	10	
Turn-Off Delay Time		t <sub>d(off)</sub>	-	19	40	
Fall Time		t <sub>f</sub>	-	10	20	
Gate Charge	(V <sub>DS</sub> = 400 Vdc, I <sub>D</sub> = 5 Adc, V <sub>GS</sub> = 10 Vdc)	Q <sub>T</sub>	-	5.0	10	nC
		Q <sub>1</sub>	-	2.7	-	
		Q <sub>2</sub>	-	2.0	-	

## SOURCE-DRAIN DIODE CHARACTERISTICS

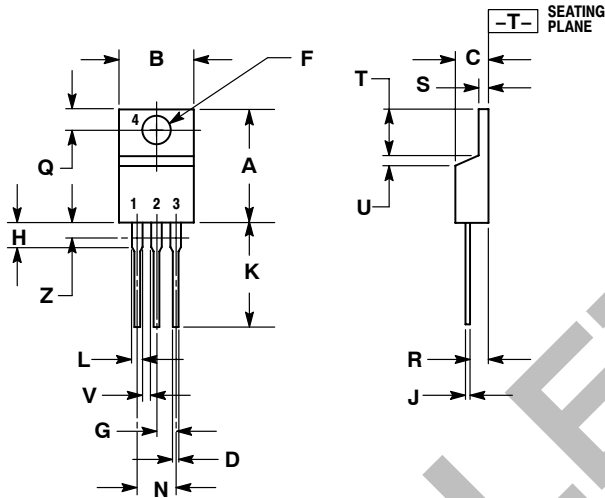
Forward On-Voltage (Note 1)	(I <sub>S</sub> = 5 Adc, V <sub>GS</sub> = 0 Vdc) (I <sub>S</sub> = 5 Adc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	V <sub>SD</sub>	-	0.86	1.0	Vdc
			-	0.75	-	
Reverse Recovery Time	(I <sub>S</sub> = 5 Adc, V <sub>GS</sub> = 0 Vdc, di <sub>S</sub> /dt = 100 A/μs)	t <sub>rr</sub>	-	655	-	ns
		t <sub>a</sub>	-	103	-	
		t <sub>b</sub>	-	552	-	
Reverse Recovery Stored Charge		Q <sub>RR</sub>	-	1.9	-	μC

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

# NTP5N60

## PACKAGE DIMENSIONS

TO-220 THREE-LEAD  
TO-220AB  
CASE 221A-09  
ISSUE AA



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	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.89	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 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 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

**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: 81-3-5773-3850

**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