

# NTP5863N

## N-Channel Power MOSFET 60 V, 97 A, 7.8 mΩ



ON Semiconductor®

<http://onsemi.com>

### Features

- Low  $R_{DS(on)}$
- High Current Capability
- 100% Avalanche Tested
- These Devices are Pb-Free, Halogen Free and are RoHS Compliant

**MAXIMUM RATINGS** ( $T_J = 25^\circ\text{C}$  Unless otherwise specified)

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		$V_{DSS}$	60	V
Gate-to-Source Voltage – Continuous		$V_{GS}$	$\pm 20$	V
Gate-to-Source Voltage – Nonrepetitive ( $T_P < 10 \mu\text{s}$ )		$V_{GS}$	30	V
Continuous Drain Current	Steady State	$I_D$	97	A
			68	
Power Dissipation	Steady State	$P_D$	150	W
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	$I_{DM}$	383	A
Operating and Storage Temperature Range		$T_J, T_{stg}$	-55 to +175	°C
Source Current (Body Diode)		$I_S$	97	A
Single Pulse Drain-to-Source Avalanche Energy ( $L = 0.1 \text{ mH}, I_{L(pk)} = 56 \text{ A}$ )		$E_{AS}$	157	mJ
Peak Diode Recovery (dV/dt)		dV/dt	4.1	V/ns
Lead Temperature for Soldering Purposes (1/8" from Case for 10 Seconds)		$T_L$	260	°C

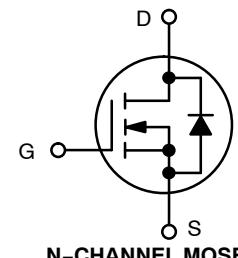
### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Case (Drain) Steady State	$R_{\theta JC}$	1.0	°C/W
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	36	

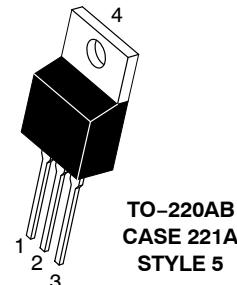
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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

$V_{(BR)DSS}$	$R_{DS(on) \text{ MAX}}$	$I_D \text{ MAX}$
60 V	7.8 mΩ @ 10 V	97 A

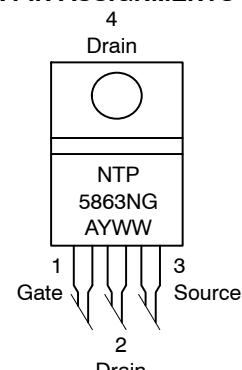


N-CHANNEL MOSFET



TO-220AB  
CASE 221A  
STYLE 5

### MARKING DIAGRAMS & PIN ASSIGNMENTS



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

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

# NTP5863N

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ Unless otherwise specified)

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

### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(\text{BR})\text{DSS}}$	$V_{\text{DS}} = 0 \text{ V}, I_{\text{D}} = 250 \mu\text{A}$	60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(\text{BR})\text{DSS}/T_J}$	$I_{\text{D}} = 250 \mu\text{A}$ , ref to $25^\circ\text{C}$		47		$\text{mV}/^\circ\text{C}$
Zero Gate Voltage Drain Current	$I_{\text{DSS}}$	$V_{\text{GS}} = 0 \text{ V}$ $V_{\text{DS}} = 60 \text{ V}$	$T_J = 25^\circ\text{C}$		1.0	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		50	
Gate-Body Leakage Current	$I_{\text{GSS}}$	$V_{\text{DS}} = 0 \text{ V}, V_{\text{GS}} = \pm 20 \text{ V}$			$\pm 100$	nA

### ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	$V_{\text{GS}(\text{th})}$	$V_{\text{GS}} = V_{\text{DS}}, I_{\text{D}} = 250 \mu\text{A}$	2.0		4.0	V
Negative Threshold Temperature Coefficient	$V_{\text{GS}(\text{th})/T_J}$			9.1		$\text{mV}/^\circ\text{C}$
Drain-to-Source On-Resistance	$R_{\text{DS}(\text{on})}$	$V_{\text{GS}} = 10 \text{ V}, I_{\text{D}} = 20 \text{ A}$		6.5	7.8	$\text{m}\Omega$
Forward Transconductance	$g_{\text{FS}}$	$V_{\text{DS}} = 15 \text{ V}, I_{\text{D}} = 30 \text{ A}$		12		S

### CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	$C_{\text{iss}}$	$V_{\text{DS}} = 25 \text{ V}, V_{\text{GS}} = 0 \text{ V}, f = 1 \text{ MHz}$		3200		pF
Output Capacitance	$C_{\text{oss}}$			350		
Transfer Capacitance	$C_{\text{rss}}$			230		
Total Gate Charge	$Q_{\text{G}(\text{TOT})}$	$V_{\text{GS}} = 10 \text{ V}, V_{\text{DS}} = 48 \text{ V}, I_{\text{D}} = 48 \text{ A}$		55		nC
Threshold Gate Charge	$Q_{\text{G}(\text{TH})}$			3.4		
Gate-to-Source Charge	$Q_{\text{GS}}$			14.5		
Gate-to-Drain Charge	$Q_{\text{GD}}$			19		
Gate Resistance	$R_{\text{G}}$			0.4		$\Omega$

### SWITCHING CHARACTERISTICS, $V_{\text{GS}} = 10 \text{ V}$ (Note 3)

Turn-On Delay Time	$t_{\text{d}(\text{on})}$	$V_{\text{GS}} = 10 \text{ V}, V_{\text{DD}} = 48 \text{ V}, I_{\text{D}} = 48 \text{ A}, R_{\text{G}} = 2.5 \Omega$		10		ns
Rise Time	$t_{\text{r}}$			34		
Turn-Off Delay Time	$t_{\text{d}(\text{off})}$			25		
Fall Time	$t_{\text{f}}$			9.0		

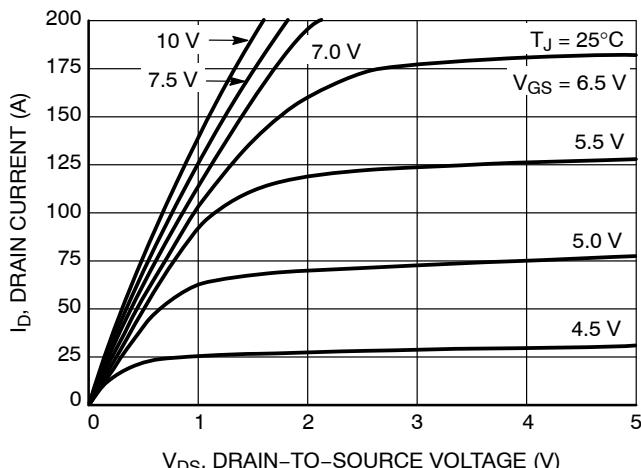
### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{\text{SD}}$	$V_{\text{GS}} = 0 \text{ V}$ $I_{\text{S}} = 48 \text{ A}$	$T_J = 25^\circ\text{C}$		0.96	1.5	$V_{\text{dc}}$
			$T_J = 150^\circ\text{C}$		0.85		
Reverse Recovery Time	$t_{\text{rr}}$	$V_{\text{GS}} = 0 \text{ V}_{\text{dc}}, I_{\text{S}} = 48 \text{ A}_{\text{dc}}, \frac{dI_{\text{S}}}{dt} = 100 \text{ A}/\mu\text{s}$			32		ns
Charge Time	$t_{\text{a}}$				20		
Discharge Time	$t_{\text{b}}$				12		
Reverse Recovery Stored Charge	$Q_{\text{RR}}$				28		nC

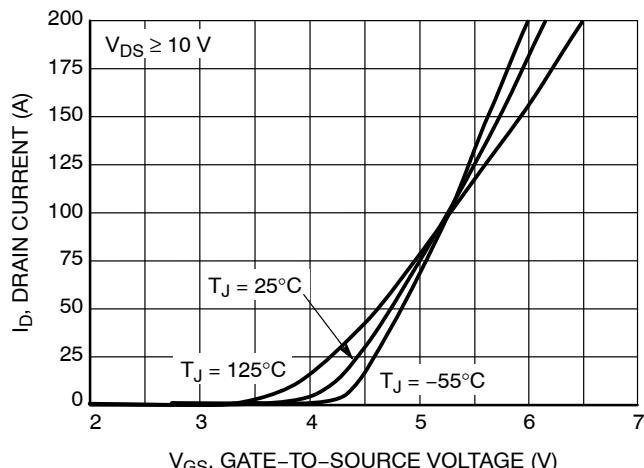
2. Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

3. Switching characteristics are independent of operating junction temperatures.

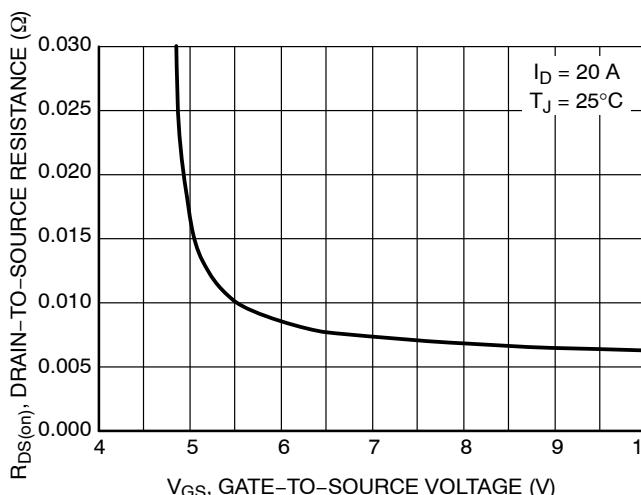
**TYPICAL PERFORMANCE CHARACTERISTICS**



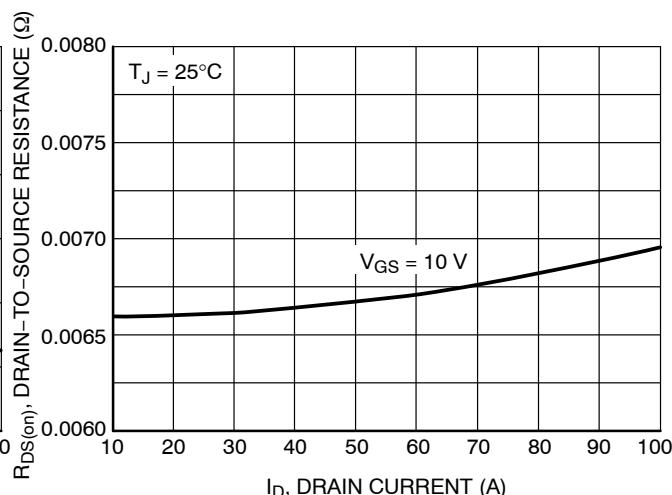
**Figure 1. On-Region Characteristics**



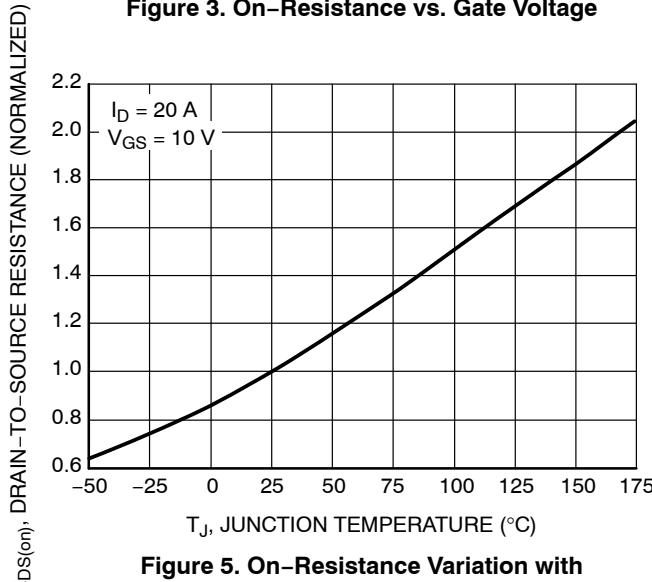
**Figure 2. Transfer Characteristics**



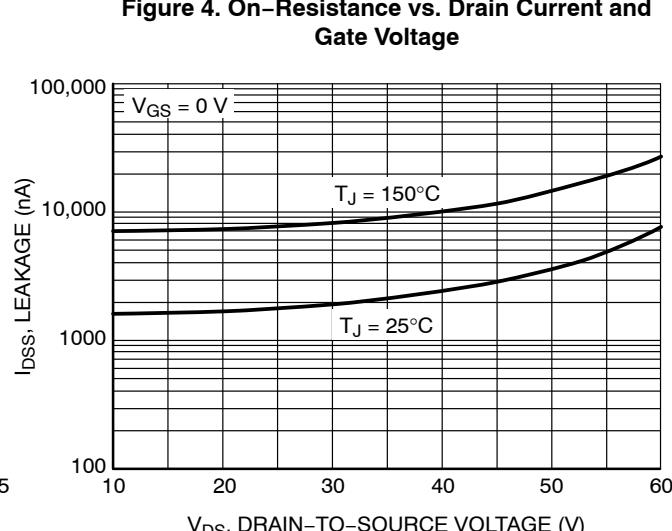
**Figure 3. On-Resistance vs. Gate Voltage**



**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**

TYPICAL PERFORMANCE CHARACTERISTICS

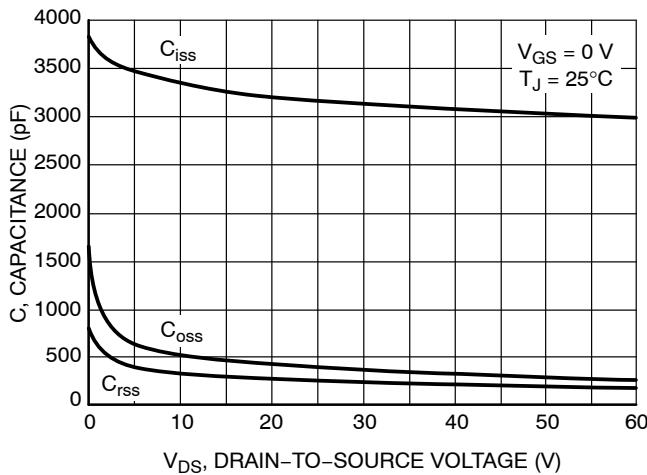


Figure 7. Capacitance Variation

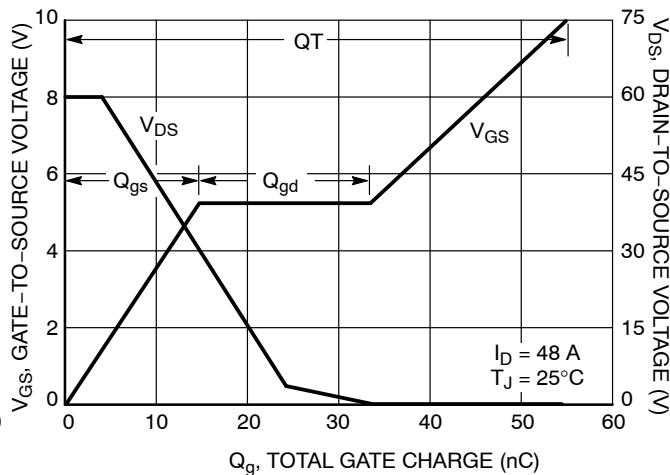


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

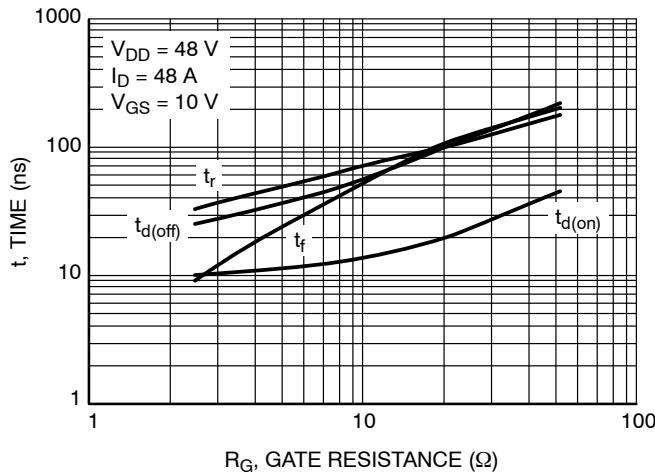


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

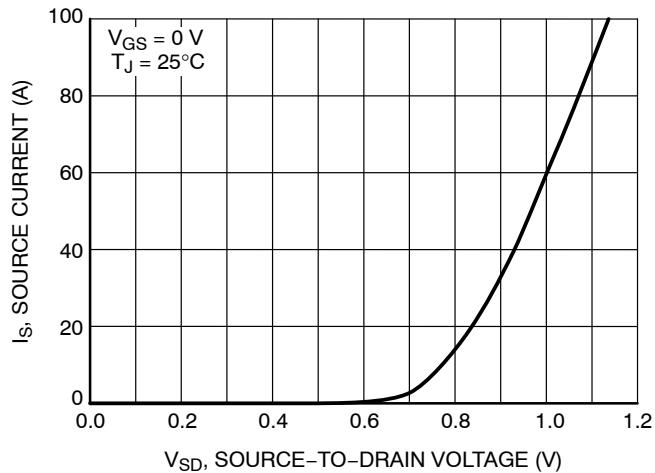


Figure 10. Diode Forward Voltage vs. Current

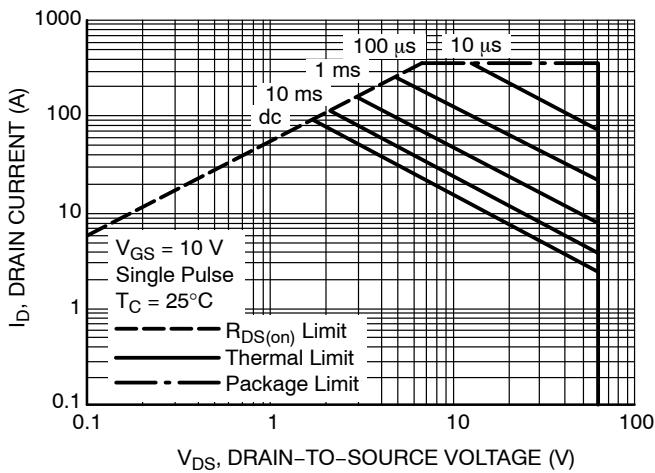


Figure 11. Maximum Rated Forward Biased Safe Operating Area

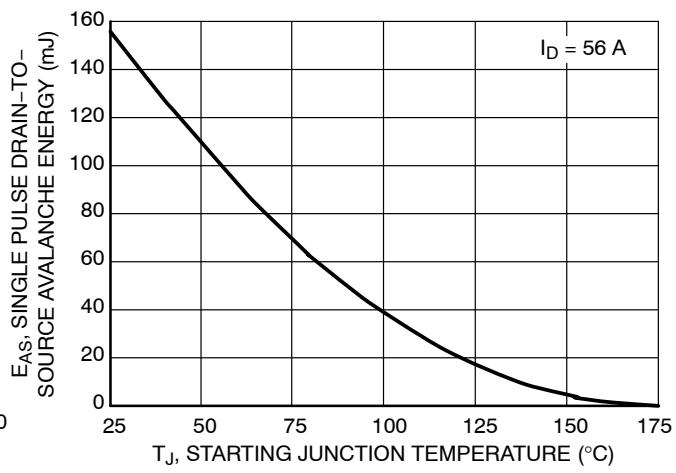
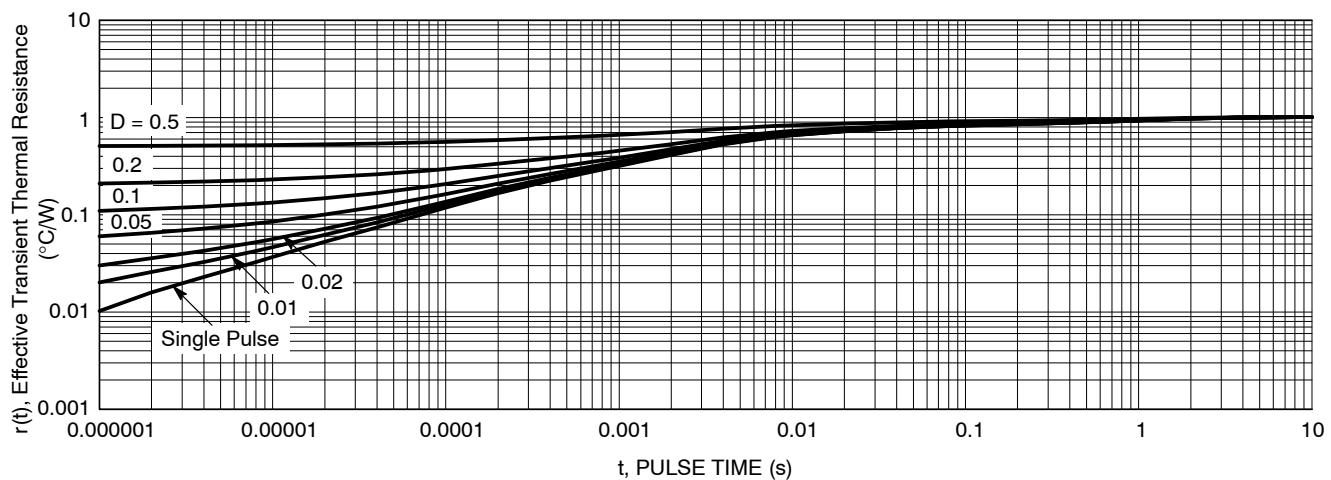


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

**TYPICAL PERFORMANCE CHARACTERISTICS****Figure 13. Thermal Response****ORDERING INFORMATION**

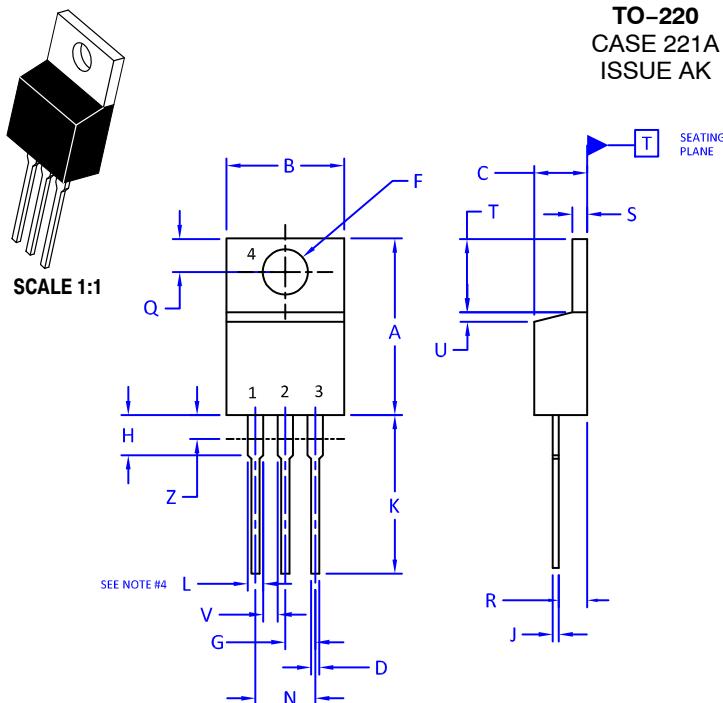
Device	Package	Shipping <sup>†</sup>
NTP5863NG	TO-220AB (Pb-Free)	50 Units / Rail

<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.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

onsemi™



DATE 13 JAN 2022

- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 2009.
  2. CONTROLLING DIMENSION: INCHES
  3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.
  4. MAX WIDTH FOR F102 DEVICE = 1.35MM

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	3.60	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	1.41
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 1:  
PIN 1. BASE  
2. COLLECTOR  
3. Emitter  
4. COLLECTOR

STYLE 5:  
PIN 1. GATE  
2. DRAIN  
3. SOURCE  
4. DRAIN

STYLE 9:  
PIN 1. GATE  
2. COLLECTOR  
3. Emitter  
4. COLLECTOR

STYLE 2:  
PIN 1. BASE  
2. Emitter  
3. COLLECTOR  
4. Emitter

STYLE 6:  
PIN 1. ANODE  
2. CATHODE  
3. ANODE  
4. CATHODE

STYLE 10:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN  
4. SOURCE

STYLE 3:  
PIN 1. CATHODE  
2. ANODE  
3. GATE  
4. ANODE

STYLE 7:  
PIN 1. CATHODE  
2. ANODE  
3. CATHODE  
4. ANODE

STYLE 11:  
PIN 1. DRAIN  
2. SOURCE  
3. GATE  
4. SOURCE

STYLE 4:  
PIN 1. MAIN TERMINAL 1  
2. MAIN TERMINAL 2  
3. GATE  
4. MAIN TERMINAL 2

STYLE 8:  
PIN 1. CATHODE  
2. ANODE  
3. EXTERNAL TRIP/DELAY  
4. ANODE

STYLE 12:  
PIN 1. MAIN TERMINAL 1  
2. MAIN TERMINAL 2  
3. GATE  
4. NOT CONNECTED

DOCUMENT NUMBER:	98ASB42148B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	TO-220	PAGE 1 OF 1

onsemi and ONSEMI are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi 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. onsemi does not convey any license under its patent rights nor the rights of others.

**onsemi, ONSEMI, and other names, marks, and brands** are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'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). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** 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. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** 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. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** 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 **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** 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:

Email Requests to: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

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

### TECHNICAL SUPPORT

#### North American Technical Support:

Voice Mail: 1 800-282-9855 Toll Free USA/Canada

Phone: 011 421 33 790 2910

#### Europe, Middle East and Africa Technical Support:

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative