

# MTP20N15E

## Power MOSFET 20 Amps, 150 Volts N-Channel TO-220

This Power MOSFET is designed to withstand high energy in the avalanche and commutation modes. The energy efficient design also offers a drain-to-source diode with a fast recovery time. Designed for low voltage, high speed switching applications in power converters and PWM motor controls, these devices are particularly well suited for bridge circuits where diode speed and commutating safe operating areas are critical and offer additional safety margin against unexpected voltage transients.

- Avalanche Energy Specified
- Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- Diode is Characterized for Use in Bridge Circuits
- $I_{DSS}$  and  $V_{DS(on)}$  Specified at Elevated Temperature
- This is a Pb-Free Device\*

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

Rating	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	150	Vdc
Drain-Gate Voltage ( $R_{GS} = 1.0\text{ M}\Omega$ )	$V_{DGR}$	150	Vdc
Gate-Source Voltage - Continuous - Non-Repetitive ( $t_p \leq 10\text{ ms}$ )	$V_{GS}$ $V_{GSM}$	$\pm 20$ $\pm 32$	Vdc
Drain - Continuous - Continuous @ $100^\circ\text{C}$ - Single Pulse ( $t_p \leq 10\text{ }\mu\text{s}$ )	$I_D$ $I_D$ $I_{DM}$	20 12 60	Adc
Total Power Dissipation Derate above $25^\circ\text{C}$	$P_D$	112 0.9	Watts $\text{W}/^\circ\text{C}$
Operating and Storage Temperature Range	$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$
Single Drain-to-Source Avalanche Energy - Starting $T_J = 25^\circ\text{C}$ ( $V_{DD} = 120\text{ Vdc}$ , $V_{GS} = 10\text{ Vdc}$ , $I_L = 20\text{ Apk}$ , $L = 0.3\text{ mH}$ )	$E_{AS}$	60	mJ
Thermal Resistance - Junction to Case - Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	1.1 62.5	$^\circ\text{C}/\text{W}$
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	$T_L$	260	$^\circ\text{C}$

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.

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

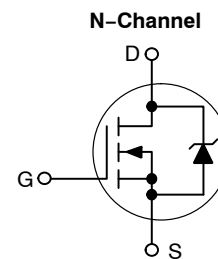


ON Semiconductor™

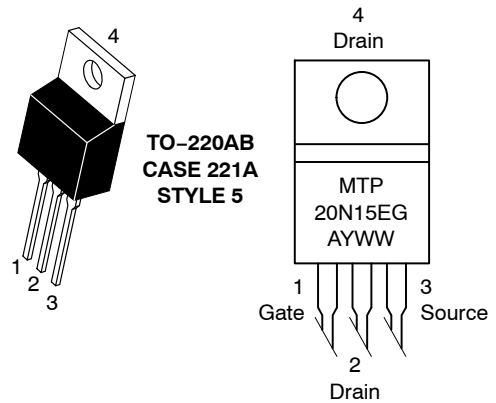
<http://onsemi.com>

**20 AMPERES  
150 VOLTS**

$R_{DS(on)} = 130\text{ m}\Omega$



### MARKING DIAGRAM & PIN ASSIGNMENT



MTP20N15E = Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

Device	Package	Shipping
MTP20N15EG	TO-220AB (Pb-Free)	50 Units/Rail

# MTP20N15E

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

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

### OFF CHARACTERISTICS

Drain-Source Breakdown Voltage (V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 0.25 mAdc) Temperature Coefficient (Positive)	V <sub>(BR)DSS</sub>	150 -	- TBD	- -	Vdc mV/°C
Zero Gate Voltage Collector Current (V <sub>DS</sub> = 150 Vdc, V <sub>GS</sub> = 0 Vdc) (V <sub>DS</sub> = 150 Vdc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	I <sub>DSS</sub>	- -	- -	10 100	μAdc
Gate-Body Leakage Current (V <sub>GS</sub> = ± 20 Vdc, V <sub>DS</sub> = 0)	I <sub>GSS(f)</sub> I <sub>GSS(r)</sub>	- -	- -	100 100	nAdc

### ON CHARACTERISTICS (Note 1.)

Gate Threshold Voltage (V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 0.25 mAdc) Temperature Coefficient (Negative)	V <sub>GS(th)</sub>	2.0 -	- TBD	4.0 -	Vdc mV/°C
Static Drain-Source On-Resistance (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 10 Adc)	R <sub>DS(on)</sub>	-	0.12	0.13	Ohm
Drain-Source On-Voltage (V <sub>GS</sub> = 10 Vdc) (I <sub>D</sub> = 20 Adc) (I <sub>D</sub> = 10 Adc, T <sub>J</sub> = 125°C)	V <sub>DS(on)</sub>	- -	- -	2.8 2.6	Vdc
Forward Transconductance (V <sub>DS</sub> = 13 Vdc, I <sub>D</sub> = 10 Adc)	g <sub>FS</sub>	8.0	11	-	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>	-	1133	1627	pF
Output Capacitance		C <sub>oss</sub>	-	332	474	
Transfer Capacitance		C <sub>rss</sub>	-	105	174	

### SWITCHING CHARACTERISTICS (Note 2.)

Turn-On Delay Time	(V <sub>DD</sub> = 75 Vdc, I <sub>D</sub> = 20 Adc, V <sub>GS</sub> = 10 Vdc, R <sub>G</sub> = 9.1 Ω)	t <sub>d(on)</sub>	-	11	25	ns
Rise Time		t <sub>r</sub>	-	77	153	
Turn-Off Delay Time		t <sub>d(off)</sub>	-	33	67	
Fall Time		t <sub>f</sub>	-	49	97	
Gate Charge	(V <sub>DS</sub> = 120 Vdc, I <sub>D</sub> = 20 Adc, V <sub>GS</sub> = 10 Vdc)	Q <sub>T</sub>	-	39.1	55.9	nC
		Q <sub>1</sub>	-	7.5	-	
		Q <sub>2</sub>	-	22	-	
		Q <sub>3</sub>	-	17	-	

### SOURCE-DRAIN DIODE CHARACTERISTICS

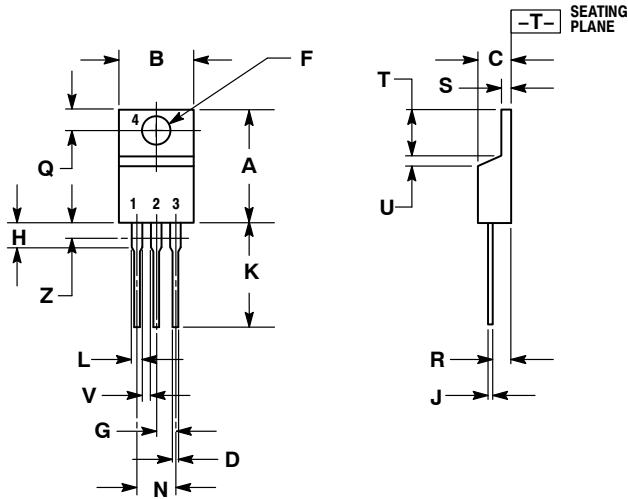
Forward On-Voltage (Note 1.)	(I <sub>S</sub> = 20 Adc, V <sub>GS</sub> = 0 Vdc) (I <sub>S</sub> = 20 Adc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	V <sub>SD</sub>	- -	- -	1.5 -	Vdc
Reverse Recovery Time		(I <sub>S</sub> = 20 Adc, V <sub>GS</sub> = 0 Vdc, di <sub>S</sub> /dt = 100 A/μs)	t <sub>rr</sub>	-	160	-
	t <sub>a</sub>		-	123	-	
	t <sub>b</sub>		-	36.5	-	
Reverse Recovery Stored Charge		Q <sub>RR</sub>	-	1.1	-	μC

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

# MTP20N15E

## PACKAGE DIMENSIONS

TO-220  
CASE 221A-09  
ISSUE AF



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	0.161	3.61	4.09
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.014	0.025	0.36	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	4.83	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  
2: DRAIN  
3: SOURCE  
4: 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

MTP20N15E/D