

# MTP20N15E

Preferred Device

## 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

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

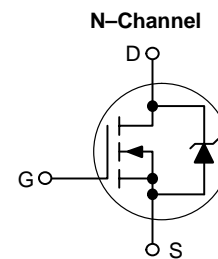
Rating	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	150	Vdc
Drain-Gate Voltage ( $R_{GS} = 1.0\text{ M}\Omega$ )	$V_{DGR}$	150	Vdc
Gate-Source Voltage	$V_{GS}$	$\pm 20$	Vdc
– Continuous	$V_{GSM}$	$\pm 32$	Vdc
– Non-Repetitive ( $t_p \leq 10\text{ ms}$ )			
Drain – Continuous	$I_D$	20	Adc
– Continuous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



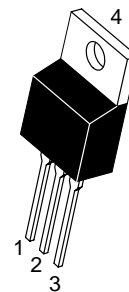
ON Semiconductor™

<http://onsemi.com>

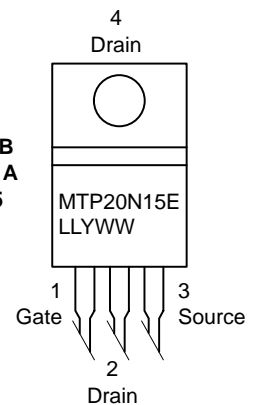
**20 AMPERES**  
**150 VOLTS**  
 **$R_{DS(on)} = 130\text{ m}\Omega$**



### MARKING DIAGRAM & PIN ASSIGNMENT



TO-220AB  
CASE 221A  
STYLE 5



MTP20N15E = Device Code  
LL = Location Code  
Y = Year  
WW = Work Week

### ORDERING INFORMATION

Device	Package	Shipping
MTP20N15E	TO-220AB	50 Units/Rail

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

# 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

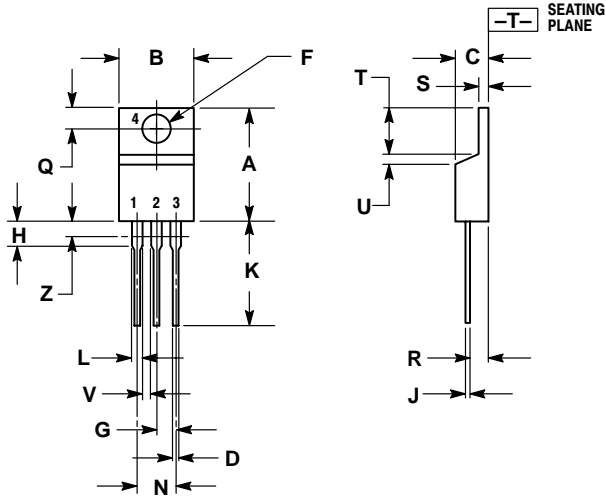
Forward On–Voltage (Note 1.)	(I <sub>S</sub> = 20 Adc, V <sub>GS</sub> = 0 Vdc) (I <sub>S</sub> = 20 Adc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	V <sub>SD</sub>	– –	– –	1.5 –	Vdc
Reverse Recovery Time	(I <sub>S</sub> = 20 Adc, V <sub>GS</sub> = 0 Vdc, dI <sub>S</sub> /dt = 100 A/μs)	t <sub>rr</sub>	–	160	–	ns
		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 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	4.83	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  are 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.

## PUBLICATION ORDERING INFORMATION

### **NORTH AMERICA 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:** ONlit@hibbertco.com  
Fax Response Line: 303-675-2167 or 800-344-3810 Toll Free USA/Canada

**N. American Technical Support:** 800-282-9855 Toll Free USA/Canada

**EUROPE:** LDC for ON Semiconductor – European Support

**German Phone:** (+1) 303-308-7140 (Mon-Fri 2:30pm to 7:00pm CET)  
**Email:** ONlit-german@hibbertco.com  
**French Phone:** (+1) 303-308-7141 (Mon-Fri 2:00pm to 7:00pm CET)  
**Email:** ONlit-french@hibbertco.com  
**English Phone:** (+1) 303-308-7142 (Mon-Fri 12:00pm to 5:00pm GMT)  
**Email:** ONlit@hibbertco.com

**EUROPEAN TOLL-FREE ACCESS\*: 00-800-4422-3781**

\*Available from Germany, France, Italy, UK, Ireland

### **CENTRAL/SOUTH AMERICA:**

**Spanish Phone:** 303-308-7143 (Mon-Fri 8:00am to 5:00pm MST)  
**Email:** ONlit-spanish@hibbertco.com  
**Toll-Free from Mexico:** Dial 01-800-288-2872 for Access –  
then Dial 866-297-9322

**ASIA/PACIFIC:** LDC for ON Semiconductor – Asia Support

**Phone:** 303-675-2121 (Tue-Fri 9:00am to 1:00pm, Hong Kong Time)  
**Toll Free from Hong Kong & Singapore:**  
**001-800-4422-3781**  
**Email:** ONlit-asia@hibbertco.com

**JAPAN:** ON Semiconductor, Japan Customer Focus Center

4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-0031  
**Phone:** 81-3-5740-2700  
**Email:** r14525@onsemi.com

**ON Semiconductor Website:** <http://onsemi.com>

For additional information, please contact your local Sales Representative.