# 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°C unless otherwise noted)

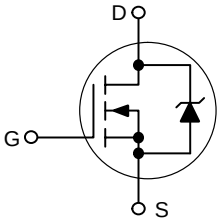
| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Drain–Source Voltage | $V_{DSS}$ | 150 | Vdc |
| Drain–Gate Voltage ($R_{GS}$ = 1.0 MΩ) | $V_{DGR}$ | 150 | Vdc |
| Gate–Source Voltage<br>– Continuous<br>– Non–Repetitive ($t_p \le 10$ ms) | <br>$V_{GS}$<br>$V_{GSM}$ | <br>± 20<br>± 32 | Vdc |
|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

ON Semiconductor™

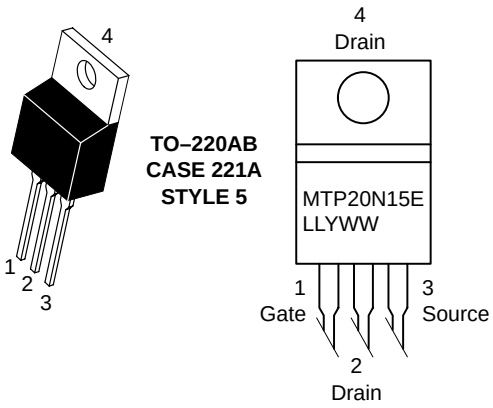
http://onsemi.com

**20 AMPERES**
**150 VOLTS**
**$R_{DS(on)}$ = 130 mΩ**

**N–Channel**




**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.

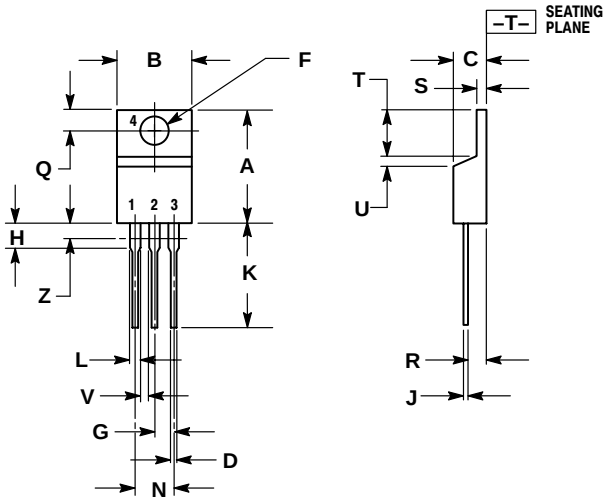
**ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C unless otherwise noted)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain–Source Breakdown Voltage ($V_{GS}$ = 0 Vdc, $I_D$ = 0.25 mAdc)<br>Temperature Coefficient (Positive) | | $V_{(BR)DSS}$ | 150<br>– | –<br>TBD | –<br>– | Vdc<br>mV/°C |
| Zero Gate Voltage Collector Current ($V_{DS}$ = 150 Vdc, $V_{GS}$ = 0 Vdc)<br>($V_{DS}$ = 150 Vdc, $V_{GS}$ = 0 Vdc, $T_J$ = 125°C) | | $I_{DSS}$ | –<br>– | –<br>– | 10<br>100 | μAdc |
| Gate–Body Leakage Current ($V_{GS}$ = ± 20 Vdc, $V_{DS}$ = 0) | | $I_{GSS(f)}$<br>$I_{GSS(r)}$ | –<br>– | –<br>– | 100<br>100 | nAdc |
| **ON CHARACTERISTICS** (Note 1.) | | | | | | |
| Gate Threshold Voltage ($V_{DS}$ = $V_{GS}$, $I_D$ = 0.25 mAdc)<br>Temperature Coefficient (Negative) | | $V_{GS(th)}$ | 2.0<br>– | –<br>TBD | 4.0<br>– | Vdc<br>mV/°C |
| Static Drain–Source On–Resistance ($V_{GS}$ = 10 Vdc, $I_D$ = 10 Adc) | | $R_{DS(on)}$ | – | 0.12 | 0.13 | Ohm |
| Drain–Source On–Voltage ($V_{GS}$ = 10 Vdc) ($I_D$ = 20 Adc)<br>($I_D$ = 10 Adc, $T_J$ = 125°C) | | $V_{DS(on)}$ | –<br>– | –<br>– | 2.8<br>2.6 | Vdc |
| Forward Transconductance ($V_{DS}$ = 13 Vdc, $I_D$ = 10 Adc) | | $g_{FS}$ | 8.0 | 11 | – | mhos |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance | ($V_{DS}$ = 25 Vdc, $V_{GS}$ = 0 Vdc, f = 1.0 MHz) | $C_{iss}$ | – | 1133 | 1627 | pF |
| Output Capacitance | | $C_{oss}$ | – | 332 | 474 | |
| Transfer Capacitance | | $C_{rss}$ | – | 105 | 174 | |
| **SWITCHING CHARACTERISTICS** (Note 2.) | | | | | | |
| Turn–On Delay Time | ($V_{DD}$ = 75 Vdc, $I_D$ = 20 Adc, $V_{GS}$ = 10 Vdc, $R_G$ = 9.1 Ω) | $t_{d(on)}$ | – | 11 | 25 | ns |
| Rise Time | | $t_r$ | – | 77 | 153 | |
| Turn–Off Delay Time | | $t_{d(off)}$ | – | 33 | 67 | |
| Fall Time | | $t_f$ | – | 49 | 97 | |
| Gate Charge | ($V_{DS}$ = 120 Vdc, $I_D$ = 20 Adc, $V_{GS}$ = 10 Vdc) | $Q_T$ | – | 39.1 | 55.9 | nC |
| | | $Q_1$ | – | 7.5 | – | |
| | | $Q_2$ | – | 22 | – | |
| | | $Q_3$ | – | 17 | – | |
| **SOURCE–DRAIN DIODE CHARACTERISTICS** | | | | | | |
| Forward On–Voltage (Note 1.) | ($I_S$ = 20 Adc, $V_{GS}$ = 0 Vdc)<br>($I_S$ = 20 Adc, $V_{GS}$ = 0 Vdc, $T_J$ = 125°C) | $V_{SD}$ | –<br>– | –<br>– | 1.5<br>– | Vdc |
| Reverse Recovery Time | ($I_S$ = 20 Adc, $V_{GS}$ = 0 Vdc, $dI_S/dt$ = 100 A/μs) | $t_{rr}$ | – | 160 | – | ns |
| | | $t_a$ | – | 123 | – | |
| | | $t_b$ | – | 36.5 | – | |
| Reverse Recovery Stored Charge | | $Q_{RR}$ | – | 1.1 | – | μC |

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

## 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.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | 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
2. DRAIN
3. SOURCE
4. DRAIN

## 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.