# 500V 20A N-Channel Enhancement Mode Power MOSFET

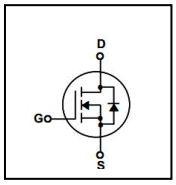
## General Description

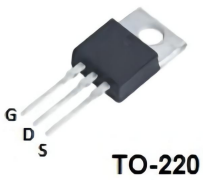
BXP20N50 is Bridgelux high voltage MOSFET family based on advanced planar DMOS technology. This advanced MOSFET family has optimized on-state resistance, and also provides superior switching performance and higher avalanche energy strength. This device family is suitable for high efficiency switch mode power supplies.

## FEATURES

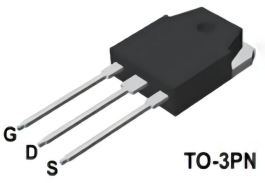
- RDSON≤0.3Ω @Vgs=10V, Id=10A
- Excellent $R_{DS(ON)}$ and Low Gate Charge
- Fast switching capability
- Lead free product is acquired

## SYMBOL








## ASSEMBLY MESSAGE

| Product Name | Package | Packaging |
|---|---|---|
| BXP20N50P | TO-220 | Tube |
| BXP20N50F | TO-220F | Tube |
| BXP20N50A | TO-3PN | Tube |

## ABSOLUTE MAXIMUM RATINGS ($T_C$=25°C unless otherwise noted)

| Parameter | | Symbol | Rating | | | Unit |
|---|---|---|---|---|---|---|
| | | | BXP20N50P | BXP20N50F | BXP20N50A | |
| Drain-Source Voltage | | $V_{DSS}$ | 500 | | | V |
| Drain Current | Continuous ($T_C$ = 25°C) | $I_D$ | 20 | | | A |
| | Continuous ($T_C$ = 100°C) | | 12.5 | | | A |
| Drain Current | Pulsed (Note1) | $I_{DM}$ | 80 | | | A |
| Gate-Source Voltage | | $V_{GSS}$ | ±30 | | | V |
| Avalanche Energy | Single Pulse (Note2) | $E_{AS}$ | 1200 | | | mJ |
| Avalanche Current (Note1) | | $I_{AR}$ | 20 | | | A |
| Peak Diode Recovery dv/dt (Note3) | | dv/dt | 5 | | | V/ns |
| Power Dissipation (Note 2) | $T_C$ =25°C | $P_D$ | 176 | 39 | 208 | W |
| | Derate above 25°C | | 1.41 | 0.31 | 1.66 | W/°C |
| Maximum Junction Temperature | | $T_J$ | 150 | | | °C |
| Storage Temperature Range | | $T_{STG}$ | -55 to 150 | | | °C |

Note: 1. Repetitive Rating: Pulse width limited by maximum junction temperature

2. L=6mH, $I_{AS}$=20A, $V_{DD}$=50V, RG=25 Ω, Starting TJ = 25°C

3. $I_{SD}$ ≤20A, di/dt ≤ 300A/μs, $V_{DD}$ ≤ $BV_{DSS}$, Starting TJ = 25°C

## THERMAL CHARACTERISTICS

| Parameter | Symbol | Max. | | | Unit |
|---|---|---|---|---|---|
| | | BXP20N50P | BXP20N50F | BXP20N50A | |
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.71 | 3.2 | 0.6 | °C / W |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 53 | 62 | 41 | °C / W |

## ELECTRICAL CHARACTERISTICS（$T_J$=25℃,unless otherwise Noted）

| Parameter | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | VGS=0V, ID=250μA | 500 | | | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | VDS=500V, VGS=0V | | | 1 | uA |
| | | VDS=400V, TC = 125°C | | | 100 | uA |
| Gate-Body Leakage Current, Forward | $I_{GSS}$ | VGS=30V | | | 100 | nA |
| Gate-Body Leakage Current, Reverse | | VGS=-30V | | | -100 | nA |
| Breakdown Voltage Temperature Coefficient | △BVDSS/ △TJ | ID = 250 μA | | 0.67 | | V/℃ |
| **ON CHARACTERISTICS** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | VDS=VGS, ID=250μA | 2 | | 4 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | VGS=10V, ID=10A | | 0.24 | 0.3 | Ω |
| Forward Transconductance (Note4) | $g_{FS}$ | VDS = 50V, ID=10A | | 24 | | S |
| **DYNAMIC PARAMETERS** | | | | | | |
| Input Capacitance | $C_{ISS}$ | VDS=25V, VGS=0V, f=1.0MHz | | 2290 | | pF |
| Output Capacitance | $C_{OSS}$ | | | 380 | | pF |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | 30 | | pF |
| **SWITCHING PARAMETERS** | | | | | | |
| Turn-ON Delay Time | $t_{D(ON)}$ | VDD=250V, ID=20A, VGS = 10V ,RG=25Ω (Note4,5) | | 54 | | ns |
| Turn-ON Rise Time | $t_R$ | | | 166 | | ns |
| Turn-OFF Delay Time | $t_{D(OFF)}$ | | | 100 | | ns |
| Turn-OFF Fall-Time | $t_F$ | | | 85 | | ns |
| Total Gate Charge(Note5) | $Q_G$ | VDS =400V, VGS =10V, ID =20A (Note4,5) | | 51 | | nC |
| Gate Source Charge | $Q_{GS}$ | | | 12 | | nC |
| Gate Drain Charge | $Q_{GD}$ | | | 20 | | nC |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | |
| Drain-Source Diode Forward Voltage | $V_{SD}$ | IS=20A, VGS=0V | | | 1.4 | V |
| Diode Continuous Forward Current | $I_S$ | | | | 20 | A |
| Pulsed Drain-Source Current | $I_{SM}$ | | | | 80 | A |
| Reverse Recovery Time | $t_{RR}$ | VGS = 0 V, ISD = 20A di/dt=100 A/μs (Note4,5) | | 462 | | ns |
| Reverse Recovery Charge | $Q_{RR}$ | | | 5 | | nC |

Note： 4. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%

5. Essentially independent of operating temperature

## TYPICAL CHARACTERISTICS

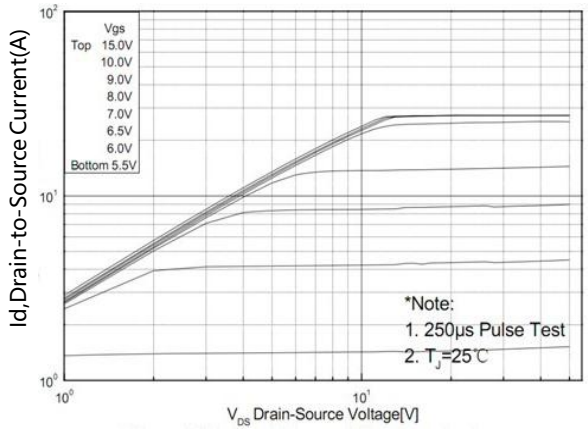



**Figure1. Typical Output Characteristics**

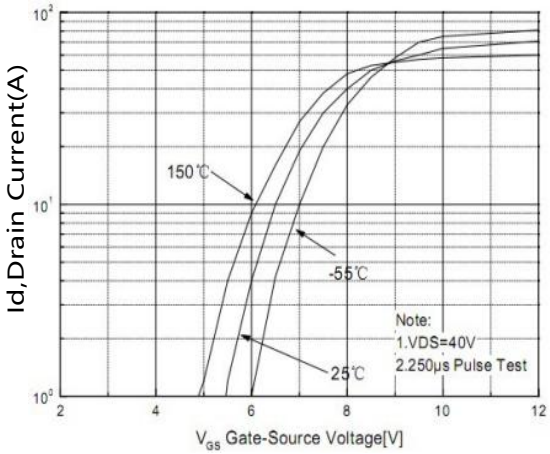



**Figure2. Typical Transfer Characteristics**

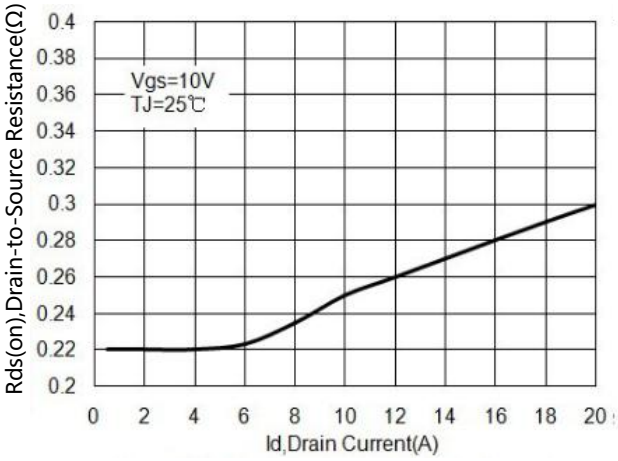



**Figure3. On-Resistance versus Drain Current**

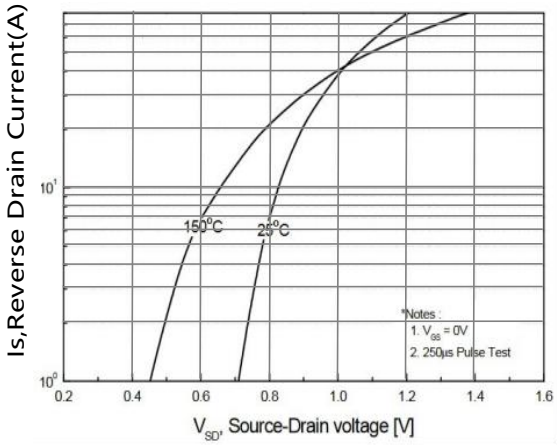



**Figure4. Diode forward voltage versus Current**

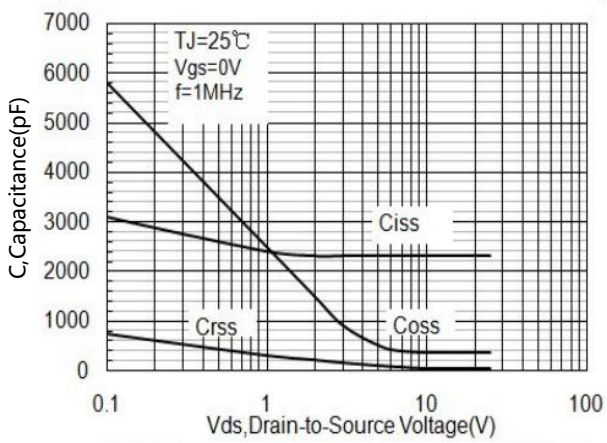



**Figure5. Typical Capacitance versus $V_{DS}$**

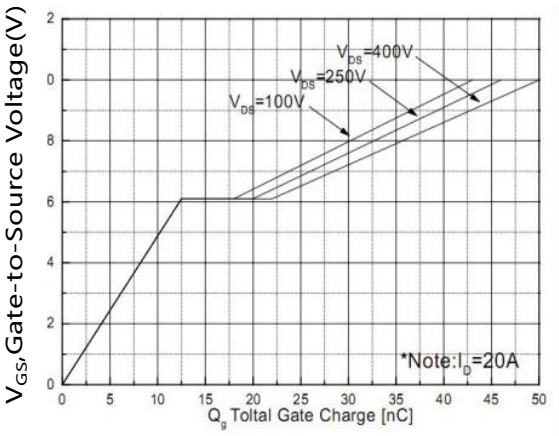



**Figure6. Typical Gate Charge versus $V_{GS}$**

## TYPICAL CHARACTERISTICS(Cont.)

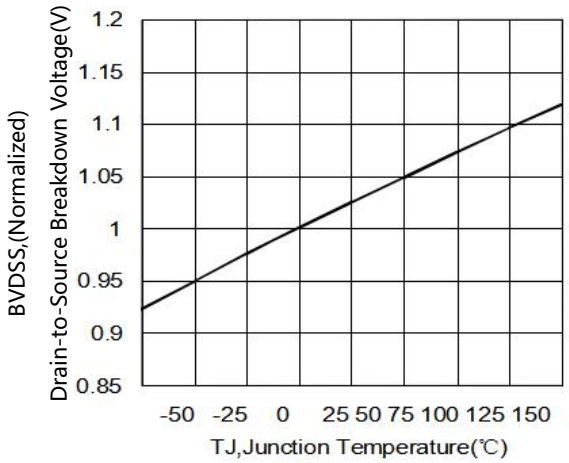



**Figure7. $BV_{DSS}$ Variation with Temperature**

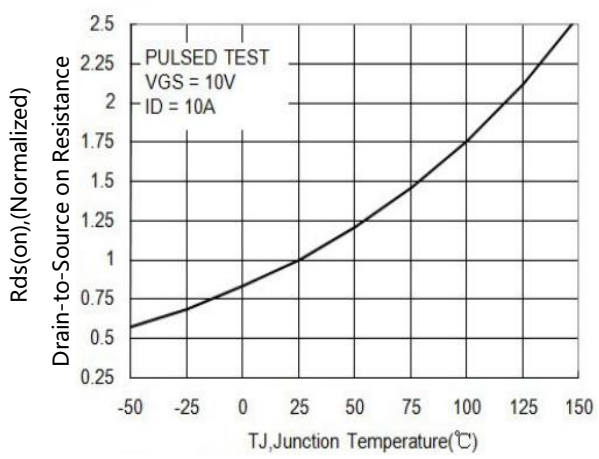



**Figure8. On-Resistance Variation with Temperature**

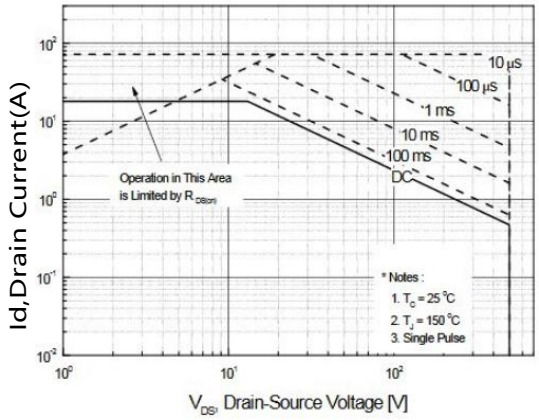



**Figure9. Maximum Safe Operating Area**

**BXP20N50P/A**

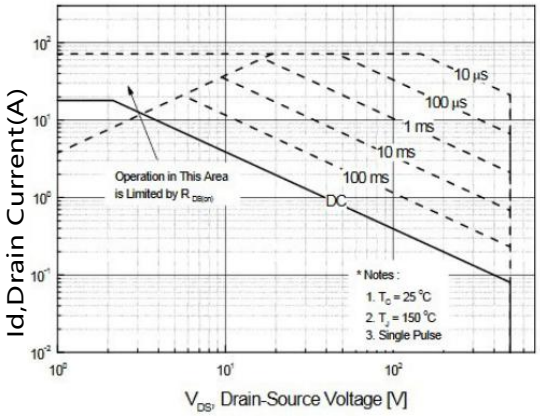



**Figure9. Maximum Safe Operating Area**

**BXP20N50F**

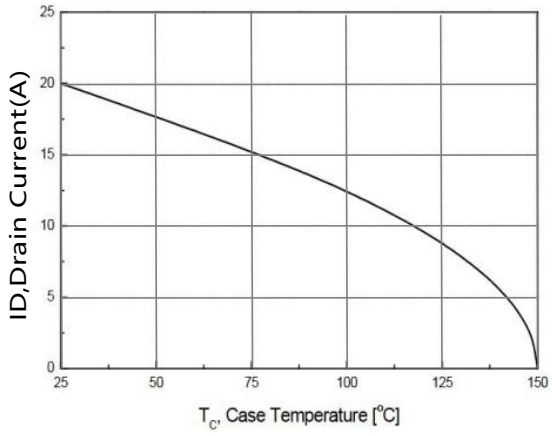
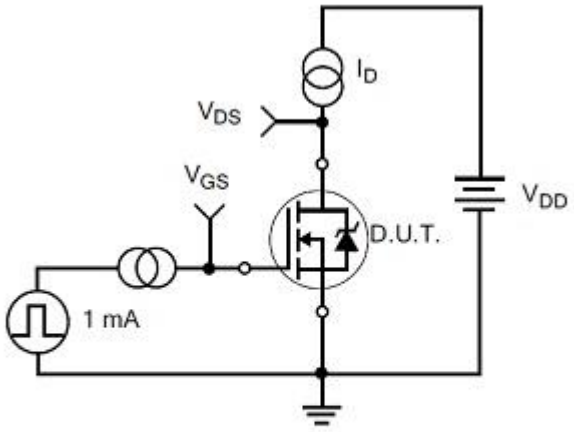
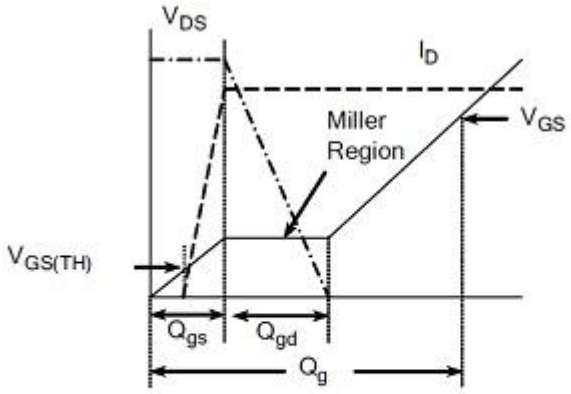



**Figure10. Maximum Continuous Drain Current versus Case Temperature**

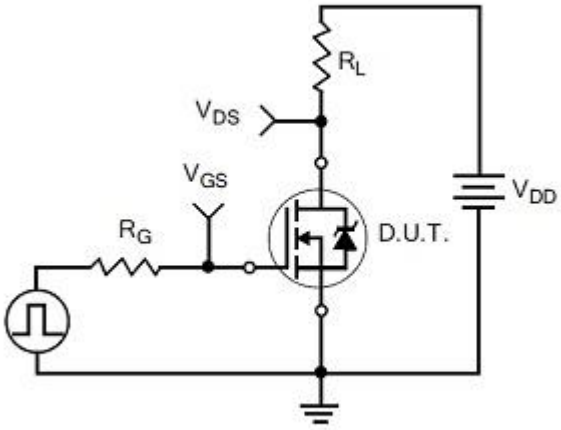
## TEST CIRCUITS AND WAVEFORMS



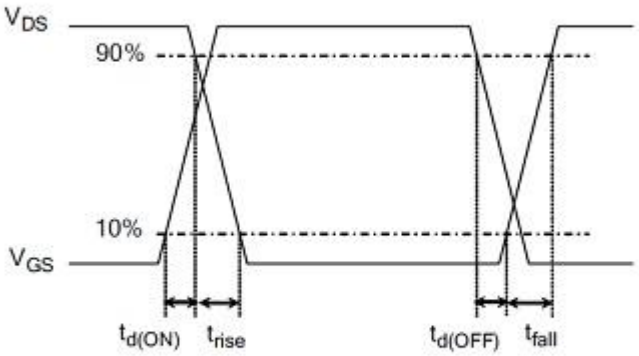

Gate Charge Test Circuit




Gate Charge Waveform

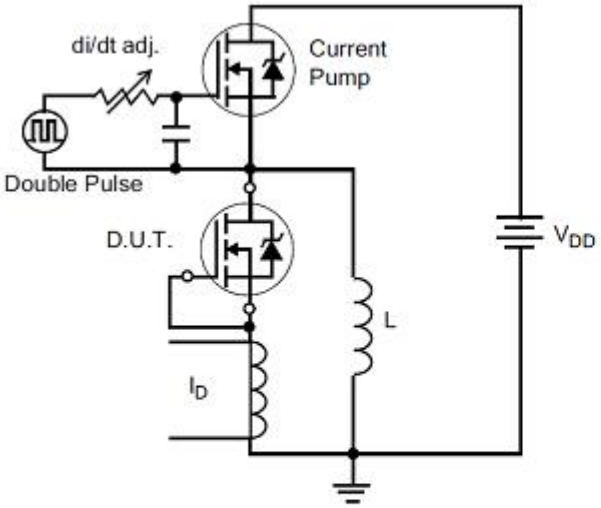



Resistive Switching Test Circuit

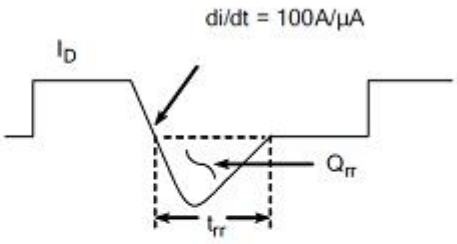



Resistive Switching Waveforms

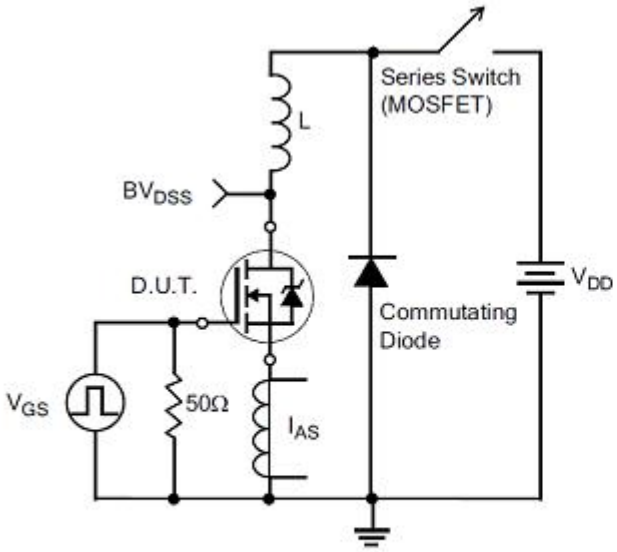
## TEST CIRCUITS AND WAVEFORMS(Cont.)



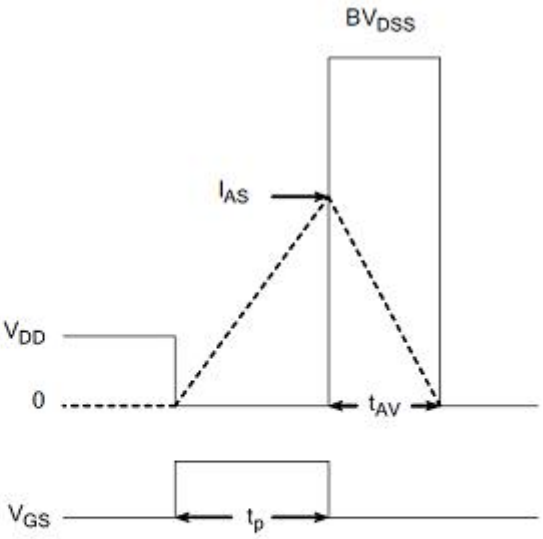

Diode Reverse Recovery Test Circuit




Diode Reverse Recovery Waveform




Unclamped Inductive Switching Test Circuit




$$E_{AS} = \frac{I_{AS}^2 L}{2}$$

Unclamped Inductive Switching Waveforms

# Revision history

## Document revision history

| Date | Revision | Changes |
|---|---|---|
| 20-Sep-2021 | 1.0 | First release |
| 5-Jan2022 | 1.1 | Update parameter |
| | | |
| | | |

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