HARRIS

# BUZ21

## N-Channel Enhancement-Mode Power Field-Effect Transistor

August 1991

### Features

- 19A, 100V
- $r_{DS(on)} = 0.1\Omega$
- SOA is Power-Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance
- Majority Carrier Device

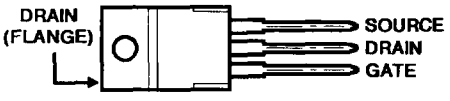
### Description

The BUZ21 is an n-channel enhancement-mode silicon-gate power field-effect transistor designed for applications such as switching regulators, switching converters, motor drivers, relay drivers, and drivers for high-power bipolar switching transistors requiring high speed and low gate-drive power. This type can be operated directly from integrated circuits.

The BUZ21 is supplied in the JEDEC TO-220AB plastic package.

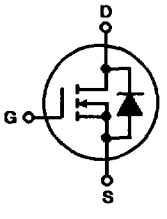
### Package

TO-220AB
TOP VIEW




### Terminal Diagram

N-CHANNEL ENHANCEMENT MODE




### Absolute Maximum Ratings ($T_C$ = +25°C), Unless Otherwise Specified

| | | BUZ21 | UNITS |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | 100 | V |
| Drain-Gate Voltage ($R_{GS}$ = 20kΩ) | $V_{DGR}$ | 100 | V |
| Continuous Drain Current $T_C$ = +55°C | $I_D$ | 19 | A |
| Pulsed Drain Current $T_C$ = +25°C | $I_{DM}$ | 75 | A |
| Single Pulse Avalanche Energy*, EAS | | 230 | mj |
| Gate-Source Voltage | $V_{GS}$ | ±20 | V |
| Maximum Power Dissipation $T_C$ = +25°C | $P_D$ | 75 | W |
| Operating and Storage Junction Temperature Range | $T_J, T_{STG}$ | -55 to +150 | °C |
| DIN Humidity Category - DIN 40040 | | E | |
| IEC Climatic Category - DIN IEC 68-1 | | 55/150/56 | |

*$V_{DD}$ = 25V, starting $T_j$ = 25°C, L = 440μHy, $R_{gs}$ = 50Ω, Ipeak = 28A, see Figures 14 and 15.

CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.

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File Number **2420**

**ELECTRICAL CHARACTERISTICS** *At Case Temperature ($T_C$) = 25°C unless otherwise specified.*

| CHARACTERISTICS | | TEST CONDITIONS | LIMITS MIN. | LIMITS TYP. | LIMITS MAX. | UNITS |
|---|---|---|---|---|---|---|
| Drain-Source Breakdown Voltage | BVDSS | VGS = 0 V<br>ID = 0.25 mA | 100 | - | - | V |
| Gate-Threshold Voltage | VGS(th) | VDS = VGS<br>ID = 1 mA | 2.1 | 3 | 4 | |
| Zero-Gate Voltage Drain Current | IDSS | Tj = 25°C<br>Tj = 125°C<br>VDS = 100 V, VGS = 0 V | -<br>- | 20<br>100 | 250<br>1000 | µA |
| Gate-Source Leakage Current | IGSS | VGS = 20 V<br>VDS = 0 V | - | 10 | 100 | nA |
| Drain-Source on Resistance | rDS(on) | VGS = 10 V<br>ID = 9 A | - | 0.09 | 0.1 | Ω |
| Forward Transconductance | gfs | VDS = 25 V<br>ID = 9 A | 4 | 8 | - | S |
| Input Capacitance | Ciss | VGS = 0 V | - | 1500 | 2000 | pF |
| Output Capacitance | Coss | VDS = 25 V | - | 450 | 700 | |
| Reverse Transfer Capacitance | Crss | f = 1 MHZ | - | 150 | 240 | |
| Turn-On Time ton | td(on) | Vcc = 30 V | - | 30 | 45 | ns |
| (ton = td(on) + tr) | tr | ID = 3 A | - | 50 | 75 | |
| Turn-Off Time toff | td(off) | VGS = 10 V | - | 170 | 220 | |
| (toff = td(off) = tr) | tr | RGS = 50 Ω | - | 80 | 110 | |
| Thermal Resistance, Junction-to-Case | RθJC | | ≤ 1.67 | | | °C/W |
| Thermal Resistance, Junction-to-Ambient | RθJA | | ≤ 75 | | | |

*VDD = 25 V, starting Tj = 25°C, L = 440 µHy, Rgs = 50 Ω, Ipeak = 28 A, see figure 14 & 15.

**SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS**

| CHARACTERISTICS | | TEST CONDITIONS | LIMITS MIN. | LIMITS TYP. | LIMITS MAX. | UNITS |
|---|---|---|---|---|---|---|
| Continuous Reverse Drain Current | IDR | Tc = 25°C | - | - | 19 | A |
| Pulsed Reverse Drain Current | IDRM | | - | - | 75 | |
| Diode Forward Voltage | VSD | IF = 2 x IDR<br>VGS = 0 V, Tj = 25°C | - | 1.5 | 2.1 | V |
| Reverse Recovery Time | trr | Tj = 25°C, IF = IDR | - | 200 | - | ns |
| Reverse Recovered Charge | QRR | dIF/dt = 100 A/µs, VR = 30 V | - | 0.25 | - | µC |

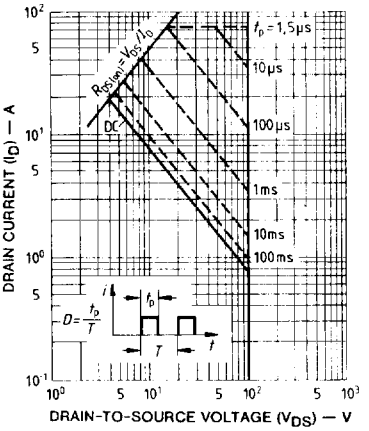


*Figure 1 - Maximum safe operating areas for all types.*

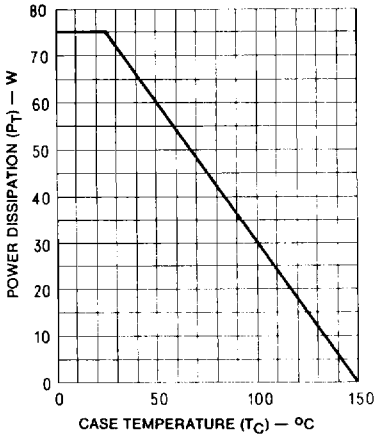


*Figure 2 - Power vs temperature derating curve for all types.*

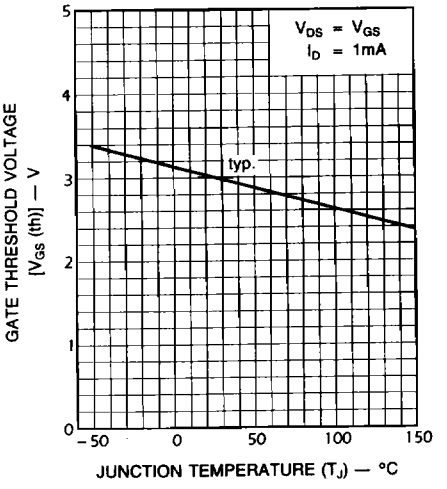


*Figure 3 - Normalized gate threshold voltage as a function of junction temperature for all types.*

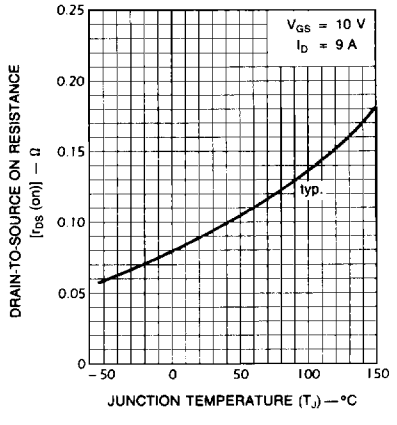


*Figure 4 - Normalized drain-to-source on resistance to junction temperature for all types.*

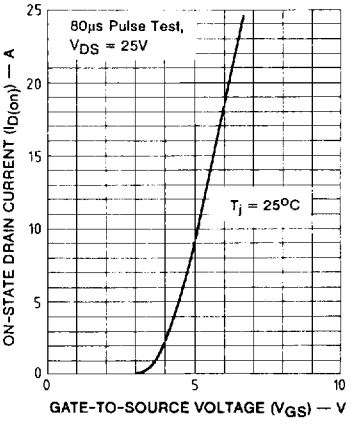


*Figure 5 - Typical transfer characteristics for all types.*

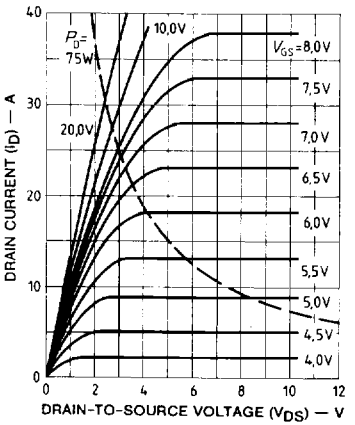


*Figure 6 - Typical output characteristics.*

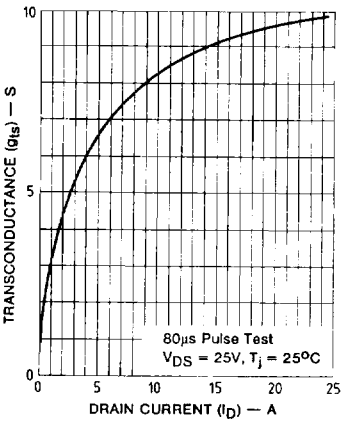


*Figure 7 - Typical transconductance vs drain current.*

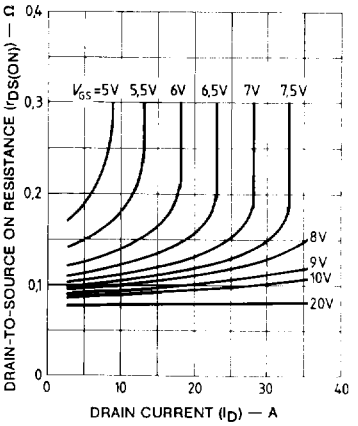


*Figure 8 - Typical on-resistance vs drain current.*

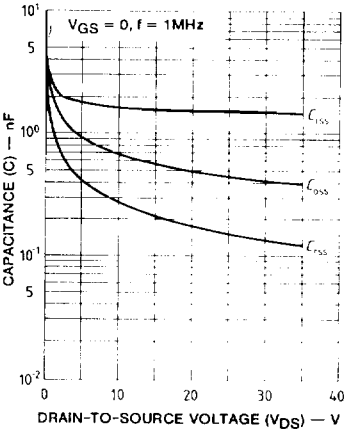


*Figure 9 - Typical capacitance vs drain-to-source voltage.*

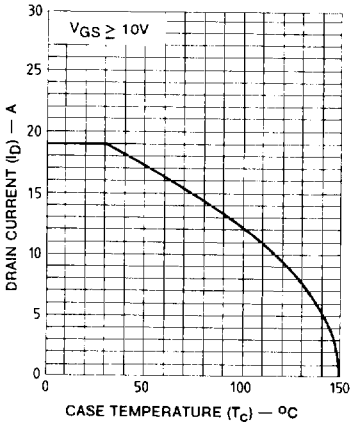


*Figure 10 - Maximum drain current vs case temperature.*

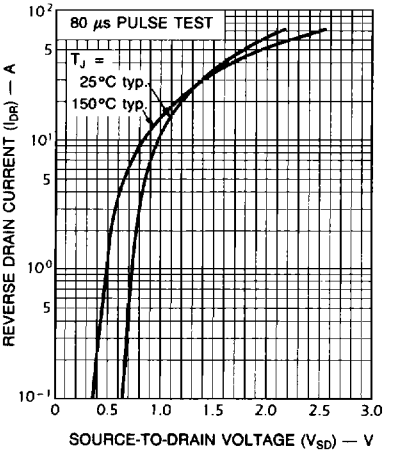


*Figure 11 - Typical source-drain diode forward voltage.*

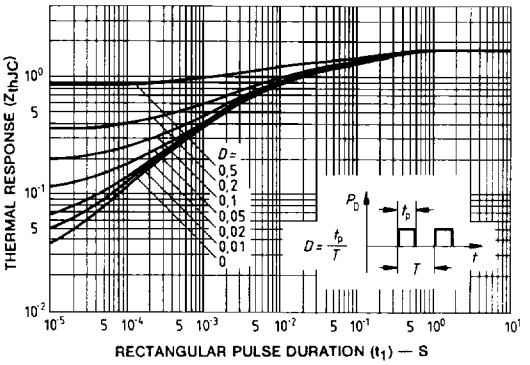


*Figure 12 - Maximum effective transient thermal impedance, junction-to-case vs pulse duration*

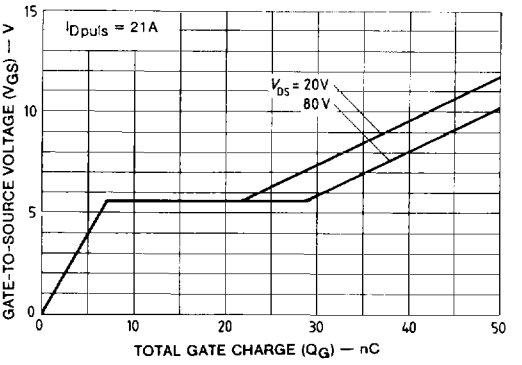


*Figure 13 - Typical gate charge vs gate-to-source voltage.*

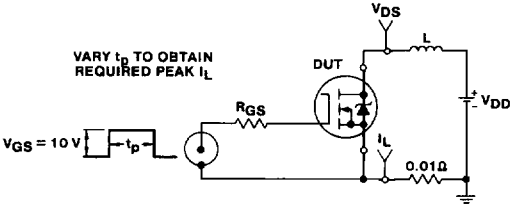


*Figure 14 - Unclamped energy test circuit.*

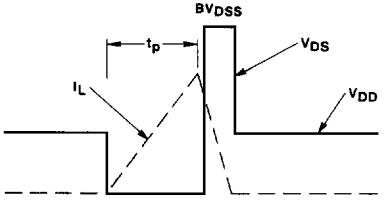


*Figure 15 - Unclamped energy test waveforms.*